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EDITORS AND PUBLISHERS:

H. A. PILSBRY, Curator of the Department of Mollusca, Academy of Natural Sciences, PHILADELPHIA.

C. W. JOHNSON, Curator of the Boston Society of Natural History, BOSTON.

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ON THE VARIATION OF APLUSTRUM AMPLUSTRE LINNE.

BY CATHARINE J. BUSH, PH.D.

Zoological Department, Yale University Museum.

A short series of exceptionally fine specimens of this species has recently been presented to the Yale University Museum by Mr. Bruce Cartwright, Jr., '05. They were collected by him on Hammer Point, Pearl Harbor, Oahu, Hawaii, where they were quite common in the sand under coral and lava rocks.

The largest is eleven-eighths inches long and seven-eighths broad, and the smallest a little over seven-eighths inches long and five-eighths broad. There is considerable variation in the height of the spire; in the largest example each whorl, beyond the minute tilted and partly immersed nuclear one, is a little raised, forming a well elevated spire of about five-sixteenths of an inch in height. In others the early whorls are coiled in the same plane, forming an obtuse apex, and in one the coiling is reversed so that the early whorls are sunken. There is also great variation in the exposure on the last whorl. The pink and white color bands do not noticeably differ in width, but the black lines bordering them do vary, and in one instance an additional black line appears in the middle of the peripheral white band. There is also great variation in the forming of the inner lip of the aperture. In some of the specimens it closely adheres to the body of the shell and has an irregular outline with a free edge, which forms a distinctly lamella-like margin, or outer wall, to a deep open canal extending the entire length of the columella. In others it is seen only as an adherent patch just beneath the suture

and again appears, curving outward, at about the middle of the columella as the lamella-like margin.

One specimen has a conspicuous groove in the middle of the peripheral white band, and although very uniform, it is undoubtedly due to injury.

The species is well figured both by Adams and Pilsbry. It has been recorded from northeast Australia, Sandwich and other islands of the Indian and Pacific oceans. Type loc., Mauritius.

A NEW FLORIDIAN AMNICOLA.

BY WILLIAM H. DALL.[1]

Some fresh-water marl from a swamp at the south end of Lake Panasoffkee, six feet below the present surface, collected by Mr. A. M. Harper, was recently submitted for examination by Mr. C. A. Davis, of the U. S. Geological Survey. It contained a number of species known to live in the region, in determining which I had the kind assistance of Dr. H. A. Pilsbry. One species which will probably be found living, later on, seems to be new.

AMNICOLA HARPERI n. sp.

Shell minute, depressed, rapidly enlarging, with about three whorls; surface smooth, except for faint incremental lines, almost polished, the whorls are full and rounded, almost circular in section, thus forming a deep suture; umbilicus wide and deep, the whorl evenly rounding into it; aperture nearly circular, with a faint angulation where it touches the preceding whorl, the margin entire, simple, slightly expanded, the plane of the aperture slightly oblique. Height of shell 1.2, diameter 1.3, diameter of aperture 0.7 mm.

This little shell looks like a very minute replica of *Valvata sincera*, and if it were not for the slight angulation of the aperture would have been referred to *Valvata*. No Lymnæas were found in the marl. The species associated with *A. harperi* were: *Pisidium* sp.; *Succinea* sp.; *Physa heterostropha*; *Ancylus tardus*; *Planorbis trivolvis*, *parvus*, *dilatatus*, and *alabamensis* var. *avus*; *Paludestrina monas* Pils., and *brevissima* Pils.; *Amnicola johnsoni* and *augustina* of Pilsbry; *Vivipara georgiana* Lea and *Goniobasis papillosa* Anth.

[1] By permission of the Director of the U. S. Geological Survey.

A NEW SPECIES OF MUSCULIUM.

BY V. STERKI.

MUSCULIUM PUSILLUM n. sp.

Mussel small, subequipartite, moderately inflated, rather rounded in outlines to subtruncate anteriorly and posteriorly; beaks very little anterior and little inclined towards the anterior, somewhat projecting, calyculate, made up wholly of the nepionic valves marked off from the post-embryonal by a deep constriction; concentric surface striæ microscopic, slight, somewhat distant, irregular, most marked and more crowded over the widest part of the beaks; color (of dead shells) whitish to straw, surface somewhat shining; shell very thin and fragile; hinge very slight but well formed, right cardinal tooth moderately curved with its posterior end thicker to even hooked, left anterior slightly curved, posterior very short, oblique. Long. 4, alt. 3.6, diam. 2.4 mill.

Soft parts not seen.

Hab.: Hancock Creek, Dickinson Co., Michigan (Upper Peninsula), collected by an expedition of the Geol. and Nat. Hist. Survey of Michigan, in 1909. Types in the museum of the Univ. of Mich. (No. 193 of the expedition's collecting), and in the Carnegie Museum (5459 of my collection of *Sphæriidæ*).

There were about a dozen specimens, all dead shells, most of them single valves and partly broken. Most of them were nearly of the same size, a few smaller (3.3 and 3.4 mm. long). They may not be full grown, but even as such they are decidedly different from immature specimens of all *Musculia* described. As to color, surface appearance and thinness of the shell, they somewhat resemble *M. ryckholti* Normand, but are less inequipartite, less oblique, less high, less inflated, and evidently smaller.

AGRIOLIMAX AGRESTIS LINN. AT WACO, TEXAS.

BY JOHN K. STRECKER, JR.

In the early portion of February, 1909, the writer, in company with Mr. Ed. Ainsworth, city editor of the Waco *Times-Herald*, vis-

ited a small rocky gully about three miles north of Waco, in quest of some fossil bones which the latter had discovered there some time previously. Our time was limited and conditions unfavorable, so that we made no attempt to explore the wooded hill on the left-hand side of the gully, but in the few hours we were in the locality I saw indications that led me to believe that a careful search would yield a good harvest of shells. A month later I returned, this time with Prof. W. T. Gooch, and together we devoted several hours to the collecting of mollusks. As a result we were enabled to add two species to the McLennan county list, *i. e.*, *Omphalina friabilis* W. G. B. and *Agriolimax agrestis* Linn.

Omphalina was found in small numbers under stones and logs lying along the foot of a rocky bluff, on the level above the gully. Prof. Gooch found the first *slug* and in the next half-hour we obtained at least a dozen more, the largest about 28 mm. in length. They were found under masses of cowdung lying along a path and were associated with various species of *Coleoptera* and a few examples of *Vitrea indentata umbilicata* Ckll. In regard to examples submitted to Bryant Walker, that gentleman writes as follows: "I think that the slug is a variety of *Agriolimax agrestis*. It has the light-colored space around the respiratory foramen and the dark reticulations characteristic of that species."

Other living mollusks found on the hill were *Helicina orbiculata tropica*, *Praticolella berlanderiana*, *Polygyra roemeri*, *P. texasiana*, *P. mooreana*, *Bulimulus dealbatus liquabilis*, *Pyramidula alternata*, *Bifidaria* sp.

As far as I know, *Agriolimax agrestis* has not previously been recorded from the State.

NOTES ON LAND-SHELLS FROM MATAGORDA PENINSULA, TEXAS.

BY JOHN K. STRECKER, JR.

On the 14th of July, 1908, I accompanied a pleasure party from Palacios, Texas, across the bay to Matagorda Peninsula. This peninsula is the long, slender projection of Matagorda county which separates the bay of the same name from the Gulf. We landed on the bay side, and while the balance of the party crossed over to the

Gulf, I made a careful search for land-shells among the drift material lying along the edges of a marshy tract about 150 yards from the bay shore. This drift consisted of broken branches and logs from 2 to 8 inches in diameter, masses of twigs and dead rushes and a few weather-worn planks. The Greek captain of the schooner "Louisa" advised me to use extreme caution in working through the drift, as ground rattlesnakes (*Sistrurus miliarius* L.) were supposed to be abundant on this portion of the peninsula. The snakes, however, failed to materialize.

In the course of an hour I found nearly 250 shells, representing eleven species. The only living specimens in the lot were three examples of *Succinea concordialis* Gld., which were attached to the under side of a plank. The balance of the lot consisted of dead shells, but the majority were in good condition, some even retaining the epidermis. The following is a list of the species obtained;

Polygyra dorfeuilliana Lea. Numerous examples in good condition. This is probably the southernmost record for this species. Pilsbry (Proc. Acad. Nat. Sci. Phila., 1907, p. 535) records a single example from Galveston, but suggests that it may have been imported. I found one specimen on the B. Y. P. U. camp-ground at Palacios. It was a dead shell in good condition and was in a situation that precluded any likelihood of its being a drift shell carried inland through human agency.

Polygyra espiloca Rav. Two examples. This species has been previously recorded from Indianola (Pilsbry).

Polygyra fraterna friersoni Pils.; 14 examples in fair condition.

Polygyra texasiana Mor.

Polygyra mooreana W. G. B.

These two species comprised nearly two-thirds of the entire lot. Living examples of both were found near Palacios.

Polygyra leporina Gld. A single imperfect example.

Polygyra cereolus volvoxis Pfr. Three examples in fair condition. This species has also been recorded from Galveston (Pilsbry) and Virginia Point, Galveston county (Singley).

Succinea concordialis Gld. Three living specimens and a number of dead ones.

Helicina orbiculata tropica Jan. Abundant. Living examples at Palacios.

Praticolella berlanderiana Mor. Abundant. Living at Palacios.

Melampus flavus Gmel. Abundant.

These shells were not intermingled with marine forms, which strew the shore on both sides of the peninsula. The identifications are by Bryant Walker.

ON THE VALIDITY OF UNIO UNDATUS BARNES.

BY BRYANT WALKER.

This species, which is apparently easily identifiable, has been buried in the synonymy for over half a century. A careful study both of the literature and of a considerable amount of material has convinced me that it is entitled to recognition as a valid species.

The synonymic history of the species is, briefly, as follows; It was described by Barnes in 1823 (Am. Jour. Sci. VI, p. 121, pl. IV, fig. 4) and was based on specimens collected by Schoolcraft in the Wisconsin and Fox rivers.

In 1828, Hildreth (Am. Jour. Sci. XIX, p. 280) recognized the species among the *Unionidæ* of the Muskingum river, Ohio, and as his paper was submitted to Barnes before publication, there is apparently no doubt but that his identification was correct.

In his first attempt at an arrangement of the North American *Unionidæ* in 1829 (Obs. I p. 32) Dr. Lea considered it as a synonym of *U. mytiloides* Raf.

In 1833, (Obs. I p. 200) after his return from Europe, where he had studied the Lamarckian types, he declared Barnes' species to be the same as *U. obliquus* of that author.

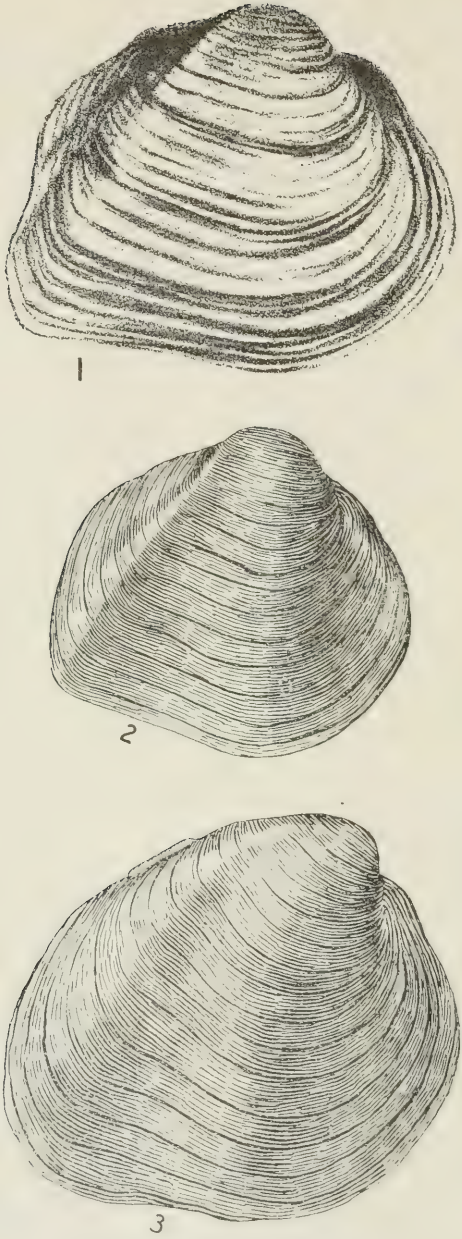
In the meantime, in 1831, Lea (Tr. Phil. Soc. IV. p. 110 pl. XVI fig. 40) had described his *Unio trigonus* from the Ohio as a new species.

It is to be noted that Barnes died in 1828 before *trigonus* was described, so that he was not able to express his opinion as to the validity of Lea's species.

In 1834, Conrad in his "Synoptical Table" (New F. W. Shells p. 72) considered the two species as synonymous and gave *undatus* priority.

In the same year, Say in his "Synonymy" (Amer. Con. Pt. VI) did the same.

Ferussac in 1835 (Guer. Mag. I p. 28), after Dr. Lea had visited



1, 2. QUADRULA TRIGONA LEA
3. QUADRULA OBLIQUA LAM

QUADRULA UNDATA BARNES.

him in Paris and identified his collection and who had had apparently before him anthentic examples of both *undatus* and *trigonus*, came to the same conclusion. He disregarded Lea's reference of *undatus* to *obliquus* Lam. and considered that species to be something quite different.

In 1849 the Western Academy of Natural Sciences of Cincinnati published a "Catalogue of the Unios, Alasmodontas and Anodontas of the Ohio River and its Northern Tributaries." It does not appear who compiled it. In this list *undatus* is recognized as a valid species with four synonyms; *i. e.*, *caridiacea* Say, *mytiloides* Raf., *obliqua* Lam, and *pyramidata* Lea. *Trigonus* is doubtfully referred to *flavus* Raf., of which *rubiginosus* Lea is considered a synonym.

Kuester (Conch. Cab. Unio, p. 58, pl. XIII, fig. 4, 1852) differs from every other writer in his disposition of the species. He considers it a white-nacred form of *Obovaria retusa* Lam. His figure represents a shell quite different from *undatus* in shape, with the surface heavily sulcate transversely. I have never seen anything like it and whatever else it may be, it certainly is not the *undatus* of Barnes. I have been unable to find any reference to this figure in Simpson's Synopsis.

In 1853 Conrad (Pr. A. N. S. Phila. VI, pp. 243–269) published an elaborate "Synopsis" of the Naides. In this, *undatus* and *trigonus* are recognized as distinct species and in a note the author gives what he considers the distinguishing characters of each. He emphatically repudiates the reference of *undatus* to Lamarck's *obliquus*, which he considers has priority over one of Lea's species.

This was the last revolt against the arrangement adopted by Dr. Lea in 1833.

After this time the preponderating influence of Dr. Lea in determining the nomenclature of the North American *Unionidæ* was sufficient to impress his opinion as to the standing of Dr. Barnes' species upon collectors, and the name practically disappears from the literature except as a synonym of *obliquus* Lam.

Simpson in his recent Synopsis (1900) follows Lea in his disposition of the species.

I.

What is the *Unio undatus* of Barnes?

There is no real difficulty in determining this question, if due con-

sideration is given to the original description and figure. It is without doubt one of the most common species in the upper Mississippi and Ohio drainage systems and is commonly known as *Quadrula trigona* Lea.

Barnes's description is very accurate and his figures (Pl. I, figs. 1 & 2) though rude are quite recognizable. As the final determination of the standing of his species must rest upon them, and the publication in which they appeared is out of date and not easily obtained, both are here reproduced, so that they may speak for themselves. In drawing his description, Barnes followed the prevalent error of the day and reversed the ends of the shell, calling the anterior extremity the posterior and *vice versa*. I have therefore interpolated the proper corrections in this particular in parentheses. The italics are as in the original.

Unio undatus.

Shell subtriangular, sub-longitudinal, very tumid, waved; lateral teeth, *two* in each valve.

Unio obliqua? M. Lamarck.

Hab. Ouisconsin and Fox Rivers. Mr. Schoolcraft.

Diam. 1. 5. Length 2.1. Breadth 2.2.

Shell thick, disks swelled behind (before), depressed before (behind), anterior (posterior) side slightly produced, rapidly narrowed, angulated; beaks projecting backward (forward) nearly as far as the posterior (anterior) side, elevated and recurved, with the ligament passing between them; anterior (posterior) lunule long heart-shaped and separated by a slightly elevated heel; hinge margin depressed between the beaks; basal margin waved and rounded behind (before), compressed in the middle, angulated before (behind); epidermis hoir-color exhibiting a light yellowish-green where the surface is worn or rubbed, wrinkled and finely striated transversely, surface glabrous. Cardinal teeth deeply sulcated and crenated; lateral teeth *two in each valve;* internal or lower one of the left valve small, but distinct and elevated, and both marked with fine dotted striæ. *Muscular impressions* deep, posterior one rough. Naker pearly white.

Remarks. This shell, as will be seen by its dimensions, has a more globose form than perhaps any other Unio. It will stand erect

on the posterior (anterior) side, and in this position has something of a pyramidal appearance.

For comparison with the author's figures I have figured (Pl. I, fig. 3) a topotype from the Fox River, Illinois, the proportionate dimensions of which are almost precisely those given by Barnes. The comparative measurements, translating Barnes's figures into millimeters, are as follows:

Barnes's type: Length 55, height 52.5, diam. 37.5 mm.

My shell: Length 53, height 51, diam. 34 mm.

To be of exactly the same proportions as Barnes's shell, the one I have figured should have the following dimensions:

Length, 53, height 50.7, diam. 36.14.

That is, the shell figured, as compared with the dimensions of the type, is proportionately .3 *mm.* greater in height and 2.14 *mm.* less in diameter than it should be to conform exactly with the type. But the difference is really too small to amount to anything.

In all other respects, the specimen corresponds with Barnes' description and, making due allowance for the crude drawing, agrees substantially with his figure. I think that there can be no doubt but that the shell I have figured is a typical example of the *undatus* of Barnes.

II.

Is *U. undatus* Bar.= *U. obliquus* Lam.?

If the foregoing identification of Barnes's species is correct, it is clear that *undatus* is not the same as the species, which is to-day universally accepted as the *obliquus* of Lamarck. For comparison with *undatus* I have figured (Pl. II, fig. 3) a specimen of the species now known as *obliquus*, of substantially the same dimensions as Lamarck's type.

A comparison of this figure with those of Barnes needs no demonstration to show that the two forms are not the same species.

What species Lamarck really had before him when he described his *obliquus* is by no means free from doubt.

His original description is as follows:

" *U. testa sublongitudinali, ovato-rotundata, obliqua, sub-epiderme candida; ligamento subduplici; dente cardinali crasso, sulcato, bipartito.* * * * *Habite la riviere de l'Ohio. A. Michaud. Distincte de la précédente* (*ligamentina*) *par sa forme: elle est renflée vers les crochets,*

déprimée vers l'autre extrémité, bisillonnée sur le coté antérieur. Longueur apparente, 61 millimètres."

This description taken by itself is too imperfect to be recognizable. Dr. Lea himself so declared in 1829 (Obs. 1 p. 36) and consequently omitted it entirely from his Synopsis of that date.

Prior to Dr. Lea's visit to Paris in 1832, owing to the indefinite character of Lamarck's descriptions, there was great uncertainty and considerable diversity of opinion among American conchologists in regard to nearly all of his species. And it was no doubt owing to that fact, that Barnes, in describing his *undatus*, intimated that it might be the *obliquus* of Lamarck. Dr. Lea never figured or described *obliquus*. But there can be no doubt but that the well-known species, which for the last fifty years at least has been called by that name, was determined by him as being the Lamarckian species.

But his decision did not meet with universal acceptance.

Ferussac in 1837 (*loc. cit.*), in whose possession were many of Lamarck's types, and who no doubt had access to the type of *obliquus*, which was then in the museum in the Garden of Plants at Paris, and after Dr. Lea had spent eight mornings critically examining and identifying his collection of American *Unionidæ*, believed that Lamarck's *obliquus* was the species described by Lea as *ebenus*.

And Conrad in his "Synopsis" of 1853 held to the same opinion, remarking that "Lamarck's description is wholly inapplicable to *undatus*, which is not oblique, and certainly not "*ovate-rotundate.*"

What Lamarck's *obliquus* really is, can probably be only determined by a critical re-examination of the original type, if it is still in existence.

But whatever it may be, it is certain that if the current acceptation of *obliquus* is correct, then it is clear that Lea's reference of *undatus* to it was erroneous. On the other hand, if Lee was right in his determination, then it is equally certain that the species now known as *Quadrula obliqua* cannot bear that name.

What it should be called in that case is "another story" as Kipling would say and may well be held in abeyance until we know what Lamarck's *obliquus* really is. And until that is definitely determined, it is, no doubt, the better part to consider the shell we call *obliquus* to be Lamarck's species and for the time being to deal with Barnes's species on that basis.

(*To be continued.*)

BOSTON MALACOLOGICAL CLUB.

A few persons interested in the study of Mollusca were entertained on the evening of Washington's birthday, by Mr. Francis N. Balch, at his home in Jamaica Plain. Plans were discussed and a meeting for organizing was called. As a result, thirteen met on March 14th. in Boston, adopted a constitution, and elected Prof. Edward S. Morse, of Salem, President; Mr. Francis N. Balch, of Boston, Vice-President; Rev. Henry W. Winkley, of Danvers, Secretary and Treasurer. Mr. John Ritchie, Jr., and Mr. Chas. W. Johnson were elected to serve with the other officers as an Executive Committee.

At the April meeting, Professor Morse gave an excellent address, protesting against the multiplication of generic names, and on some interesting points for study and observation. Mr. Balch spoke on his recent visit to Washington, of some of the interesting specimens obtained by the "Albatross" and of the work being done at the National Museum on mollusks. Some twenty-five ladies and gentlemen are now on the roll of membership.

HENRY W. WINKLEY,
Secretary.

NOTES.

Professor Robert Parr Whitfield, curator in the American Museum of Natural History, author of important works on paleontology, died on April 6, at the age of eighty-two years.

A NEW SPECIES FOR THE UNITED STATES FAUNA. Mr. W. H. Over of Date, S. D., has recently to me for determination specimens of a *Segmentina*, collected by him in a small water-hole among the Coteau Hills, five miles north-east of Clear Lake, S. D. They agree very exactly with the description and figure of *S. christyi* Dall, both in sculpture and size, the largest specimen being 11½ mm. in diameter, and I have no doubt as to their being that species. None of the seven specimens sent show any indications of apertural lamellæ.

BRYANT WALKER.

A LARGE FOSSIL TRIVIA: Among a collection of Pliocene fossils obtained by Mr. Wm. F. Clapp, from the dredgings in the lower part of Lake Flint, above Ft. Thompson, Florida, was a specimen of *Trivia pediculus* of an unusually large size. The specimen measures 22 mm.

in length, and except for size represent the typical *pediculus*, *i. e.* those with the finer ribbing, about 18 ribs showing on the inner margin of the outer lip, with about 7 intermediate ones which do not reach the inner margin. A study of the recent forms seems to warrant the varietal name of *T. pediculus permagna*.

In a large series of over 100 recent specimens there is a great range of variation; the largest is 17 mm., the smallest 6 mm., in length. The larger specimens show a noticeable unformity in size, about fifty percent measuring between 15 and 17 mm. The specimens from near Jupiter Inlet, Fla., represent for the most part the vareity *labiosa* Gask., with a perceptibly broader inner lip, with about 15 ribs extending to the inner margin. The variety *cimex* is smaller (about 8 to 10 mm.), and in the typical form there is a tending for the spots on the right side to become confluent.

C. W. JOHNSON.

FULGUR CANALICULATUM SPAWNING in the New York Aquarium is figured and described in the Zoological Society Bulletin for March, 1910, pp. 637, 638. Eight days were occupied in spawning one string of egg capsules.

AN EARLY STAGE OF ACMÆA. By EDWARD S. MORSE (Proc. Boston Soc. Nat. Hist., vol. 34, pp. 313–323, 1910). An exceedingly interesting paper in which the author shows that the young of *Acmæa testudinalis* is not nautiloid, but begins with a blunt cæcal-like cap without the suggestion of a coil. The specific characters separating *A. testudinalis* and *A. alveus* are also fully discussed.

NEW OLIGOCENE SHELLS FROM FLORIDA. By CARLOTTA JOAQUINA MAURY (Bull. Amer. Paleontology, vol. 4, No. 21, March, 1910). This Bulletin contains the descriptions and figures of 84 new species, principally from the Oak Grove and Chipola marls. The types are either in the Cornell University or the collection of Mr. T. H. Aldrich.

PALEONTOLOGY OF THE COALINGA DISTRICT, CALIFORNIA. By RALPH ARNOLD (Bull. 396 U. S. Geol. Survey). Over 50 new forms of tertiary mollusca are described and figured. *Carinifex marshalli*, proposed for *C. newberryi* Cooper (not Lea) has evidently already been named by Mr. Harold Hannibal *C. santaclaræ*, NAUTILUS, vol. 23, p. 40, July, 1909.

THE NAUTILUS.

VOL. XXIV. JUNE, 1910. No. 2

A NEW CLAIBORNIAN SHELL.

BY REV. H. E. WHEELER.

OVULACTÆON ALDRICHI, n. sp.

Shell minute, subcypræform, thick, longitudinally sculptured with distinct grooves very closely set, and terminated by the broad oblique callus on the body whorl; periphery of the apical region smooth, well rounded, the diameter of the perforation being contained in the width of the shell about four times; aperture linear, very contracted, elevated; outer lip thickened, reflected over and close to the apical perforation, and produced downward on the body whorl; furnished behind with an oblique, rather deep furrow, which is parallel to the labial contour, and terminating at the callus, a similar, less prominent rectilinear furrow directly in front.

Length 4 mm.; width 2 mm.

Type (No. 779, Col. Wheeler) from the Ferruginous Sand Bed, Claiborne, Alabama. Co-type in the collection of Hon. T. H. Aldrich.

The genus to which this shell belongs is new to Eocene paleontology. Thus far it is represented only by O. meeki Dall, a recent form dredged off the coasts of Cuba and the Bahamas. The genus is thus characterized by Dr. Dall:[1]

"Shell cypræform, involute; with an apical perforation as in Bulla;

[1] Bull. Mus. Comp. Zool. Cambridge, vol. xvii, 1889, p. 42.

columella simple, without plaits; margin of the aperture continuous, simple, thickened, the callus on the body whorl elevated parallel with the outer lip; aperture narrow, almost linear, slightly effuse at the extremities, as long as the shell.

"Type O. meekii, Dall. Plate 33, figs 3 and 4."

I dedicated this interesting shell to my friend, Hon. T. H. Aldrich, of Birmingham, Alabama, who solved the problem of its generic position, and whose contributions to our knowledge of Tertiary Paleontology are so well known and highly valued. It will be figured on a future plate of this volume.

NOTE ON THE GENUS PTERIDES.

BY H. A. PILSBRY.

In my study of this group of Mexican freshwater shells I overlooked an important article by the late Professor Sp. Brusina in the Nachrichtsblatt der Deutschen Malak. Gesellschaft for 1906, p. 154, in which he erects the new genus *Lanzaia* for the long-forgotten *Turbo elephantotus* of Megerle von Mühlfeldt, described in 1824 from the coast of Dalmatia, and rediscovered by Prof. Brusina, on the seashore near the mouth of the little river Zernovica.

This snail, *Lanzaia elephantota* as it will now be called, which is well figured in the Nachrichtsblatt (p. 158), has the aperture formed like that of my *Pterides pterostoma* (Nautilus xxiii, pl. 5, figs. 1, 2). It differs from the Mexican *Pterides* by having sinuous flat-topped riblets with close, fine spiral striæ in the intervals, and a rather large umbilicus. The Mexican *Pterides* has a smooth surface, merely rimate umbilicus, and more elongate shape.

The finding in Mexico of Mediterranean region genera, such as this one, *Emmericia* and *Coilostele* is extremely interesting and important. The more prominent groups of freshwater shells are widely diverse.

DESCRIPTIONS OF TWO NEW SPECIES OF POTAMOLITHUS.

BY H. VON IHERING, SAO PAULO, BRAZIL.

P. PAYSANDUANUS n. sp.

Shell imperforate, solid, globose, olivaceous, nearly smooth. Spire very short, conic, the apex eroded. Last whorl swollen below the suture, rounded at the base and periphery. Aperture somewhat oblique, ovate. Peristome continuous, obtuse, black, the outer and basal margins narrow, columellar and parietal margins wide, flat and black. Length 4.8; diam., 3.9 mm. Paysandú, Uruguay.

This species occurred in three forms: (1) that described above as typical.

(2) Form *sinulabris*, similar to the preceding, but with a sinus in the upper part of the outer lip.

(3) Form *impressus*, larger, with a concave zone at the upper part in the last half whorl, and a sinus in the lip, which is thin and sharp.

P. FILIPPONEI n. sp.

Shell imperforate, pyramidal, olivaceous with a reddish-brown band at the penultimate whorl, smooth. Whorls 5, strongly convex, the last strongly bicarinate, one carina peripheral, the other basal, bounding a large concave umbilical area. Aperture very oblique. Peristome continuous, outer lip thin, unexpanded, having small rounded sinuses near the upper insertion, below the peripheral angle, and at the base of the columella, which is narrow and straight. Length 4.4, diam. 4 mm.

Montevideo, Uruguay, type in Museu Paulista, collected by Dr. Florentino Filippone.

COMMON OR VERNACULAR NAMES FOR MUSSELS.

BY DR. V. STERKI.

While collecting along the Ohio River, I had some dealings with the shell hunters, the men gathering clams for the button factories,

and at the same time looking for pearls. They have some common names for certain kinds of mussels; and an official of button factories I met at Marietta, was kind enough to verify the names and to give some additional information.

"Mucket." *Lampsilis ligamentina*, also *orbiculata.*

"Pig-toe." *Quadrula obliqua*, and the whole group of approximately the same shape, also *subrotunda*, *æsopus*, etc.

"Warty pig-toe." *Q. cooperiana*, *pustulosa*, etc.

"Nigger-head." *Q. ebena;* sometimes also *Obovaria retusa.*

"Monkey face." *Q. metanevra.*

"Butterfly." *Plagiola securis.*

"Pocketbook." *L. ventricosa*, also *capax.*

"Sand clam," or "Black sand clam." *L. recta*, occasionally also *Unio gibbosus.*

"Lady's finger." *L. anodontoides*, no doubt also *fallaciosa.*

"Three-ridge washboard," or "Three-ridge," or "Washboard." *Q. undulata*, also *plicata*, and *multiplicata.*

"Razor-back," "Rudder-back," "Hatchet-back." *Proptera alata* (and, no doubt, *Symphyn. complanata*).

Some other large and common mussels may have common names, but I failed to find them out, e. g. *U. crassidens*, *Tritogonia*, *Q. lachrymosa.*

ON THE VALIDITY OF UNIO UNDATUS BARNES.

BY BRYANT WALKER.

(*Concluded from p. 10.*)

III.

Is *U. undatus* Bar. = *U. trigonus* Lea.

Lea's description of his *trigonus* is as follows:

"Shell subtriangular, inflated, nearly equilateral, depressed before the umbonial slope, angular behind; umbonial slope carinate; basal margin emarginate; substance of the shell thick, beaks prominent,

incased and slightly undulated at the tips; ligament short and thick; epidermis brown; rays obsolete; cardinal tooth large, elevated and widely cleft in the left valve and emerging from a pit in the right valve; lateral teeth thick and curved in a direction over the cardinal tooth; anterior and posterior cicatrices both distinct; dorsal cicatrices situated on the under part of the cardinal tooth; cavity of the beaks deep and angular; nacre pearly white and iridescent. Length 2.3; alt. .2; diam. 1.5 in."

It is to be noted that while this description is quite exactly in accord with the Ohio river species commonly called *trigonus*, the figure, while its dimensions are those given in the description, is not in strict accordance with its specifications nor with the shell as usually found. The shell as figured (Pl. II, fig. 1) would scarcely be called "subtriangular," but rather subquadrate; the beaks though prominent are not characteristic of the shell as it actually occurs and there is a decided emargination of the posterior slope, which is not mentioned at all in the description, and which, so far as my experience goes, does not occur in any form of *trigonus*. The figure, as it stands, would do better for a representation of the not uncommon quadrate form of *rubiginosus* than of *trigonus*.

It was probably on this account that the Western Academy of Natural Sciences, in their "Synopsis" of 1849, felt unable to determine exactly what *trigonus* was and doubtfully referred it to *flavus* Raf., of which they considered *rubiginosus* an unquestionable synonym.

Dr. Lea in his "Rectification" (Separate p. 6) speaks in the highest terms of the judicial attitude maintained by the Academy in the preparation of this list and of the impartiality with which they attempted to "render strict justice to every author."

It is to be noted in this connection that the figure of *U. pyramidatus* on Lea's plate is evidently exaggerated and out of proportion and that of *rubiginosus* in the same volume is even more so. It would therefore seem that the figure given cannot be confidently relied upon as an accurate representation either of the species or of the type.

But, however that may be, there is no real question as to what Lea's species is, although it does not appear to be a common one in the Ohio River. I have myself seen only one specimen, that figured (plate II, fig. 2). Of sixty specimens of the group recently submitted by Dr. V. Sterki for examination from the Ohio at Marietta and

intended to be a representative series of the fauna of the river at the place, not a single specimen could be satisfactorily referred to "*trigona.*" It would seem as though it did not extend up the river as far as that place.

It is unquestionable that the form I have identified as the *undatus* of Barnes has for the last half-century been uniformly considered to be the *trigonus* of Lea.

It is also true that prior to 1850, Lea's species was considered to be the same as Barnes's by a very large and respectable element among the conchologists of that time.

It is evident, also, that Dr. Lea had considerable difficulty in enforcing the adoption of his disposition of *undatus* (Syn. 4th, Ed., p. 38 n; Rectification 1st Ed. p. 15) at that time.

In considering the question *de novo* it must be admitted at once that the typical forms of the two "species" are not exactly the same.

Conrad in a note to his last Synopsis (1853), in which he considers the two forms to be distinct species states the difference aptly: it (*undatus*) "is much more ventricose anteriorly and over the umbo than *trigonus;* has more elevated beaks and is very inequilateral, whilst the latter is nearly equilateral." Dr. Lea remarks (Syn. 4th Ed. p. 38 n 3) that *trigonus* is always more angular on the umbonial slope and the undulations at the tip of the beaks differ."

This comparison does not apply to the true *undatus* of Barnes, but is correct in the first item when applied to *obliquus*, with which he considered Barnes's species to be synonymous. I have not been able to ascertain the beak characters of *obliqua* from the material at my disposal.

In considering Lea's conception of his species and whether he considered it to include the form believed to be the real *undatus* of Barnes, it may be of service to note his treatment of both species before and after his identification of *undatus* with *obliquus* in 1832.

In his original description of *trigonus* (Obs. I, p. 121) he remarks that his species belongs to the group of species which are known as *mytiloides* Raf. and has been considered a variety of that species, but that he believes that the group may be divided into four species, *mytiloides* Raf., *undatus* Bar., *pyramidatus* Lea, and *trigonus* Lea.

It is to be noted that this was before he had identified *undatus* with *obliquus*, but tends to show that he even then identified Barnes's species with the form, which he subsequently declared to be *obliquus*

Lam., which at that time he had been unable to identify from the original description. In his description of *Unio solidus* (Obs. II, p. 13), read Dec. 19, 1834, he compares that species with *undatus* and distinguishes it by "being more rounded at the basal margin, by its more elevated beaks and by its color."

In his description of *Unio planus* (Obs. III, p. 51), read Oct. 2, 1840, he differentiates that species from both *obliquus* and *trigonus* as being more rounded at the base, the emargination being very small and being higher in the beaks than *trigonus* and more flattened there than *obliquus*.

In the same paper he remarks (p. 54) that his *dolabelloides* stands between *undatus* and *cor*.

It is curious to note that as late as Feb. 19, 1841, he seems still to ignore *obliquus* on occasion and to use *undatus* (Obs. III, p. 69). But after that date, *undatus* is not referred to except in his Rectification and Synopses.

In his description of *Unio tumescens* (Obs. iv, p. 45), read May 2, 1845, he says that that species is allied to *trigonus*, but differs in being more rounded and in having rays. The comparison is certainly not a very apt one to say the least.

In his description of *Unio chunii* (Obs. ix, p. 18), read June 3, 1862, he states that this species is closely allied to *trigonus*, but may be distinguished by being more lenticular in form and in not having so sharp an umbonial slope. The undulations of the beaks of that species, however, are few, as in *trigonus*, and follow down the angle of the umbonial slope. In the same paper (p. 21) in his description of *Unio riddellii*, he remarks that that species belongs to the group of which *trigonus* may be considered the type, but differs in being rounded, even more inflated and in the character of the undulations, which are "remarkably close," while in *trigonus* they are few and follow down the angle of the umbonial slope for a short distance."

It is evident from these comparative remarks that, in Lea's mind, *trigonus* was a shell with prominent beaks, though less so than in *solidus* and *plenus*, with a rather wide basal emargination, a sharp umbonial angle, and having the beak's undulations few and following down the umbonial angle for a short distance.

These specifications apply accurately to the shell above identified as *undatus* Barnes, and do not apply to any other *Quadrula* of the Ohio drainage.

Of the fourteen species included in the "*trigona* group" by Simpson in his excellent arrangement, seven are found in the Ohio River, viz.:

Q. rubiginosa.	*Q. coccinea.*
Q. trigona.	*Q. solida.*
Q. obliqua	*Q. plena.*

Q. pyramidata.

Of these *coccinea* is quite different from any of the others, and possibly does not belong to the genus at all. (Ortmann, Naut. XXII, p. 10.) At any rate it is so entirely distinct from *trigona*, *undata* and *obliqua* that it may be dismissed from further consideration in this connection. The remaining species may be separated into two very natural groups by a characteristic difference in the form and position of the pseudo-cardinals. In his description of *trigonus*, Dr. Lea states that the "cardinal (is) large, elevated and widely cleft in the left valve and emerges from a pit in the right valve." This is absolutely correct and is one of the most characteristic specific details.

The pseudo-cardinal of the left valve is composed of two deltoid teeth separated by a deep, triangular cavity for the reception of the pseudo-cardinal of the right valve. At their upper extremity they meet and in most cases are completely fused together so that they might well be termed a single "widely cleft tooth" rather than distinct teeth. The anterior tooth is high and sharply beveled upwards to a narrow, nearly rectilinear edge, which is nearly parallel with the lower margin of the lunule. The cavity between them is deep and comparatively narrow and extends obliquely backward and upward until terminated by the fused extremities of the pseudo-cardinals. The pseudo-cardinal in the right valve is triangular in shape, with a sharp apex directed toward the beak. The posterior side is short and nearly straight up and down; the anterior side is much longer and more oblique. On both sides are deep cavities for the reception of the pseudo-cardinals of the left valve, and owing to the fusing of the upper extremities of these teeth these cavities are continued entirely around the pseudo-cardinal, which consequently appears to be "emerging from a pit."

The space between the pseudo-cardinal and lateral teeth ("interdentum") is comparatively narrow. This is clearly shown on both Barnes's and Lea's figures. This arrangement of the pseudo-car-

dinals is also characteristic of *rubiginosus*. In the remaining four of the species above mentioned, the character and relative position of the pseudo-cardinals are quite different, and are similar in all.

Taking *obliqua* as an example, the interdentum is very broad. The posterior pseudo-cardinal of the left valve is low and broadly triangular in shape and the blunt apex points obliquely forward and not directly upward; the anterior pseudo-cardinal is very low and bends around the broad and comparatively shallow socket for the opposing pseudo-cardinal. This socket is almost quadrate in shape, extends obliquely forward and a line from the upper to the lower corner is almost perpendicular. The pseudo-cardinal of the right valve is broadly triangular, and the anterior and posterior sides are about equal. It is surrounded above by a "pit" which is very shallow in front of the tooth and longer and shallower behind the tooth than in the *trigonus* group, triangular in shape and quite oblique.

The whole effect of the hinge in this group is that all the teeth are subparallel and project obliquely backwards from the beak; while in the *trigona* group the pseudo-cardinal and lateral teeth met at a decided angle under the beak.

This arrangement of the hinge in *obliqua* and its allies sensibly affects the external form of the shell, so that there is seldom any occasion for mistaking to which of the two groups any particular shell belongs.

It would seem clear, therefore, that there is no occasion for confounding the *undatus* of Barnes with any of the four species grouping about *obliqua* and that in seeking to identify that species, *obliqua* and its allies may be dismissed from further consideration.

If this be conceded, then it follows that Lea's *trigonus* is either identical with *undatus* or *rubiginosus* or is a district species from either. That the *trigonus* of Lea is specifically distinct from his *rubiginosus* does not require argument in spite of the tentative union of the two species by the Western Academy of Nat. Sciences caused no doubt by the uncharacteristic figure given by Lea of his type.

Rubiginosus is well characterized by its more broadly triangular or subquadrate and more compressed shape and less prominent beaks, which are less incurved at the tips, and the lack of the pronounced angle on the posterior ridge.

The possibility that *trigonus* and *rubiginosus* can be specifically identical may be consequently most emphatically answered in the

negative. It follows therefore that *trigonus* is identical with *undatus* or is a distinct species.

In considering this question, it is to be borne in mind that nearly all of our *Unionidæ* are subject to a large amount of variation and that the wider the range of a species, the greater the amount of variation it exhibits under the influences of diverse conditions of local environment.

Trigonus (using the term in its broad, current acceptation and not confining it to the form of Lea's type) has a very extensive range.

In the Mississippi Valley from Minnesota (Grant) south to Arkansas (Call) and northern Louisiana (Frierson); in the Ohio drainage it ranges east through Ohio (Sterki) but apparently does not extend into Pennsylvania (Ortmann) nor southwestern N. Y. (Marshall); through the ancient post-glacial connections of Lake Michigan with the Mississippi and Lake Erie with the Ohio, it has invaded the St. Lawrence system and is found in the lake drainage of Wisconsin, Illinois and southern Michigan, whence it ranges east as far as Buffalo, N. Y. (Marshall) and Port Dover, Ont. (Whiteaves), but does not appear in the valley of the Ottawa (Latchford); in Kentucky it has been recorded from the Barren River (Walker) and Warren Co. (Price) in the Ohio drainage; apparently it does not occur in the Tennessee drainage area at all; but, curiously enough it reappears in the Alabama system where it is usually, but erroneously, called *chunii* Lea.

Through Texas, southern Louisiana and Mississippi, the *trigona* group is represented by a number of "species," whose relations with each other and with *trigona* are uncertain, and can only be definitely determined by a much larger amount of material than is apparently accessible at the present time. *Trigona* as such, so far as I have been able to ascertain, has not been listed from any of those States except northern Louisiana.

While *trigona*, commonly so-called, throughout this enormous extent of territory sustains its specific identity sufficiently to be recognized in most cases without difficulty, yet, as might be expected, it exhibits in different parts of its range a considerable amount of variation.

Thus in the Mississippi, Illinois and Fox rivers, the high triangular form, which I have identified with *undatus*, is the prevalent phase; in the Ohio a more equilateral form (typical *trigona*) occurs

and similar shells are before me from the Wisconsin river, Sauk Co., Wis., and the Mississippi River at Davenport, Ia.; while in the Kaskaskia and Spoon rivers, Ills., a shellmore broadly triangular in form is found, which apparently represents the extreme in that direction. The Alabama form is closer to typical *undatus*, but like many of the northern species, that have obtained a foothold in that system and retained their specific identity, is apparently uniformly smaller and resembles a half-grown example of the common Mississippi expression of the species.

But taking the series thus specified as a whole, it exhibits a similarity throughout, which is congruous only with specific identity and which separates it as a whole from union with any other described species. And in this assemblage and united by a series of unmistakable intermediates are the *undatus* of Barnes and the *trigonus* of Lea.

If, in addition to what has already been said, anything further is needed to prove the identity of the two forms, the following comparison of the specific characters of the two species as given in the original descriptions will show that there is no ground for questioning their specific identity.

Undatus.	*Trigonus.*
Subtriangular.	Subtriangular, nearly equilateral.
Disks swelled before, depressed behind, posterior side slightly produced, rapidly narrowed, angulated.	Inflated, depressed before the umbonial slope, angular behind, umbonial slope carinated.
Basal margin waved.	Basal margin emarginate.
Shell thick.	Substance of shell thick.
Beaks elevated, recurved, projecting forwards nearly as far as the anterior side.	Beaks prominent, incurved.
Ligament passing between the beaks.	Ligament short and thick.
Epidermis horn-colored, wrinkled and finely striated transversely, surface glabrous.	Epidermis brown, rays obsolete.
Cardinal teeth deeply sulcated and crenated.	Cardinal tooth in the left valve large, elevated and widely cleft.

Lateral teeth two in each valve.	Lateral teeth thick and curved in a direction over the cardinal tooth.
Muscular impression deep, posterior one rough.	Anterior and posterior cicatrices both distinct.
Nacre pearly-white.	Nacre pearly-white and iridescent.
Length 2.2. in.	Length 2.3 in.
Alt. 2.1 in.	Alt. 2.0 in.
Diam. 1.5 in.	Diam. 1.5 in.

If then, our contention is correct as to the absolute specific identity of the two species, priority must be given to Barnes's name and the synonomy must be written as follows:

QUADRULA UNDATA (Barnes).

1823, *Unio undatus* Barnes, Am. Jl. Sci. VI, p. 121, pl. IV, fig. 4.

1831, *Unio trigonus* Lea, Tr. Am. Phil. Soc. IV, p. 110, pl. XVI, fig. 40.

EXPLANATION OF PLATES I AND II.

Pl. 1 fig. 1. *Q. undata*, Facsimile of one of Barnes's figures.

Pl. 1 fig. 2. Copy of Barnes's other figure.

Pl. 1 fig. 3. *Q. undata*, Fox River, Ill. (original).

Pl. II fig. 1. Facsimile of Lea's figure of *Unio trigonus*.

Pl. II fig. 2. *Q. trigona* Lea, Ohio River (original).

Pl. II fig. 3. *Q. obliqua* Lam. Paint Rock River, Jackson Co., Ala. (original).

NOTES.

THREE SHELLS NOT HITHERTO REPORTED FROM THE DISTRICT OF COLUMBIA.—Recent collecting has added the following hitherto unreported shells to the fauna of the District of Columbia or its environs: *Polygyra palliata* Say (on the Virginia side of the Potomac near Great Falls); *Zonitoides milium* Morse, *Punctum pygmæum* Drap.—G. DALLAS HANNA.

The albino *Oliva angulata*, noticed in the March number, has now found a home with the Academy of Science at Minneapolis, Minn. —A. L. HETTRICH.

THE NAUTILUS.

VOL. XXIV. JULY, 1910. No. 3

SHELL COLLECTING IN PUGET SOUND AND ALASKA.

BY DR. FRED BAKER, SAN DIEGO, CAL.

During the last summer it was my good fortune to take a most enjoyable trip to Seattle, Washington, where the Alaska-Yukon-Pacific Fair was in full swing; to the San Juan Islands in Puget Sound, where the Summer School of the University of Washington was in session; and on to Alaska, reaching a point as far west as Cook's Inlet. At all points possible I collected shells, and a full list of species and localities follows at the end of this article. It is a grateful task to acknowledge help in naming all doubtful species at the hands of Dr. W. H. Dall and Dr. Paul Bartsch of the National Museum, and the Rev. Geo. W. Taylor of Nanaimo, British Columbia. Without their help this article could only have been an account of the wanderings of a very amateurish conchologist.

The University of Washington, in connection with several other institutions which join forces with her, conducts a summer school on a group of islands in Puget Sound,—there are a hundred and fifty of them which constitute the county of San Juan in the State of Washington,—and here my wife and I dropped down on about fifty of the best people on earth, as biologists always are. This year they were trying the experiment of doing work in two places, and we arrived just in time to help them move camp from San Juan Island to Olga, on Orcas Island, thirteen miles away.

Orcas Island, the second largest of the group, supports a considerable farming population, but is much broken, and boasts a peak, Mt. Constitution, 2660 feet high, from which we had a glorious pano-

ramic view in all directions over thousands of square miles of water with scores of islands, and the mainland rising foothill above foothill to the Olympics and the Selkirks with their snowy ranges, and dominating and crowning all, the splendid peaks of Mt. Baker and Mt. Rainier.

We were soon established in camp quarters after our arrival, and regular work got under way. Here I met for the first time Dr Kellogg of Williams College, who was doing some most interesting work on the siphonal currents of the pelecypods. Others were doing equally interesting original work in various lines of botany and zoology, but of course the dredging was most important from my point of view. Their dredging was done by a regular shrimp dredger who was employed by the season. The apparatus is crude but very efficient. A trawl twelve feet wide was used, and as the water is shallow everywhere, the boat only carried about fifty fathoms of cable. No soundings were taken, but the depths, which generally varied between ten and thirty fathoms, were ascertained from the charts. I have done considerable work with the Alexander Agassiz, the boat of the Marine Biological Association of San Diego, and I spent five days aboard the Fish Commission Steamer Albatross off San Diego, but I have never seen such a wealth of material as we got at all stations. The great trawl always filled in a few minutes, but I was impressed by the fact that the variety of species was not nearly so great as in our more southern waters. As no one was specially interested in mollusks, I was allowed the privilege of taking any of the dredgings which I could handle. In fact we were royally treated by everybody at the station, and I shall always count the ten days we spent there as "the best yet."

A week later we were on our way to Alaska, that country of which some one has said, "If you are old, go by all means; but if you are young, wait. The scenery of Alaska is much grander than anything else of the kind in the world, and it is not well to dull one's capacity by seeing the finest first." As representatives of one of our local papers we were a part of the National Editorial Association, and as far as we went all Alaska was ours for the asking. The usual Alaska trip consists of a run from Seattle up to Skagway and back, the whole distance with the exception of a dozen miles or so being in land-locked channels, often only a few hundred yards wide, bounded by steep, heavily wooded mountains on either hand. Various towns of much

interest are visited, and a side trip up Taku Inlet shows the great Taku and Windom Glaciers. Formerly Glacier Bay was visited for a view of the Muir Glacier, but the immense amount of float ice and icebergs which have formed within the last two or three years make this visit unsafe and it has been abandoned.

On our trip we saw all that the regular tourist sees, and for full measure we ran west from Juneau into the open ocean, making a run of several hundred miles to Prince William Sound and Cook's Inlet. As we ran out of the still waters of Cross Sound into the open ocean early one morning on our right opened up the Fairweather range, one of the finest mountain ranges in all Alaska. One after another the great peaks came into view, until the whole range was off our starboard side. Many mountain ranges do not show their full extent, as to be seen the foothills must be crossed, and one's own elevation cuts down the apparent height. Here the range comes to the very ocean, and the overpowering sense of altitude is there. Four peaks rise above 10,000 feet, and Mt. Fairweather towers to 15,292 feet. From one point we could count six great glaciers, making their beginnings in the everlasting snows at the top and winding down like great rivers toward the sea.

At Cordova, on Prince William Sound, a place of 1200 people, which has grown in a year, we were taken inland fifty-three miles on the Copper River Railroad. This road, which is ultimately to reach a veritable mountain of copper, crosses several branches of the Copper River which are making the delta at its mouth, and then goes up the left bank until a point is reached where on each side, and within four miles of each other, a great glacier comes down to discharge its icebergs into the river. The face of each glacier rises sheer 350 to 400 feet, and each is over four miles wide along the river's bank. Opposite the lower, Child's Glacier, at a distance of 1500 or 2000 feet, we amused ourselves taking photographs, and repeatedly were successful in catching the great masses of ice as they broke away. In the face of this body of ice we actually suffered from the heat of the June day.

At Cordova I took advantage of a fine tide to do a couple of hours collecting, being rewarded by several good things, the best being a fine *Mactra* (*Spisula*) *alaskana* Dall. From Cordova we went to Valdez, the point of departure of the great dog teams for the Fairbanks region during the winter, but a very dull town in summer.

A year ago $700,000 worth of gold was brought out on dog sledges. Unfortunately I was not able to do much collecting here, as it is almost imperative to take a small boat and get away from the water-front of the town, and there was not sufficient time.

On the return trip we called at Ellamar, a very small mining town on a very small landlocked bay off Prince William Sound, where we had to run in on one high tide and wait for the next to take the ship out. I therefore had my work cut out for me, and, on account of the steady downpour of rain, I donned waterproof and rubber boots, and protected by an umbrella from the heaviest rain, I made the most varied and interesting catch of the Alaskan portion of my trip.

From Prince William Sound we sailed at midnight to Seward on Resurrection Bay. When I turned out in the early morning I found the tide well out and still going down, so I got busy at once. Here I found many things of interest, the best being *Trachydermon raymondi* Pilsbry, of which I succeeded in finding about a dozen. I finished my work well before the call to breakfast, and then we had a fine ride of twenty-five miles over the Alaska Central Railroad, which is now in the hands of a receiver, but was then being investigated by Mr. Geo. W. Perkins, of the firm of J. P. Morgan & Co., with a view to syndicating its completion. Since our return the papers have announced that this would be undertaken in the near future. The road already runs fifty miles into the interior through a region of marvelous beauty, and it has one unique feature of construction. At one point the engineers have blasted out a deep pass directly through a great glacier, which in future will have to be constantly cut away, as it encroaches on the railroad right of way.

From Seward we sailed down Resurrection Bay on a glorious afternoon, passing close to the rugged group of islands at the mouth, and looking back up the whole length of a great white glacier directly to the setting sun which was painting everything in matchless reds. Then the open ocean, and heavy clouds, and night settling rapidly, and cold winds driving us to our bunks for a much-needed rest.

Morning found us in Cook's Inlet, our most westerly point, and we sailed into the little station of Port Graham just at daylight. As we ran into the small bay where this station lies, we saw across the broad inlet the smoke of St. Augustine, the only volcano we saw which was even active enough to smoke. Aside from this slight

interest, it is a most beautiful mountain, a nearly regular cone rising almost from the water's edge for many thousand feet, and covered with glaring white snow from very near the base.

We spent the whole day at Port Graham, and the tide had run a long way out when we tied up. So it was overalls and rubber boots and a fine hunt of a couple of hours before breakfast. Then a hurried breakfast and three hours more of hunting. The collecting was good everywhere, so I could begin beneath the wharf and work either way. I found *Argobuccinum* (*Priene*) *oregonensis* Redfield, in quantity on the beach, and their numbers made me miss an important possibility. I had secured a considerable number of these shells in dredgings in Puget Sound, but the temptation to take more, which I suppose is the miserly instinct common to most collectors, induced me to throw a lot of them above the tide-line to be picked up later. When the tide had come up beyond the limits of profitable collecting I began to gather in this bunch of shells. Then I found among them four fine specimens of *Chrysodomus liratus* Martyn, which I had overlooked in my hurry, though they are so different that I cannot understand my blunder. It would have been more profitable to have hunted the beaches over for this last species, of which I have little doubt that I could have found as many as I could have cleaned for transportation.

At Port Graham I also found in quantity *Astarte rollandi* Bernardi. This fine shell I had not seen before, and I was glad to add it to my collection. The Indians were running around on the beach and in their bydarkas, and some of them watched me cleaning my catch. I have no doubt that my actions were a puzzle to them. None of them could be induced to talk any English, even if they knew any. However, by laying down ten cents and then tying an *Astarte*, then making use of a sign language invented for the occasion, I was able to interest a small native, and I finally kept him tying my bivalves for a couple of hours. With his help my day's work ran from 4 a. m. to 4 p. m., with very short intermissions for breakfast and lunch, so that on this day at least I felt very tired and very virtuous and slept the sleep of the just during the long night following.

Every hour of our 8000 miles of water travel was most enjoyable, as were the intervening stops, and from the point of view of a collector the trip was eminently profitable. I secured representatives

of 148 species, four of which, *Odostomia cookeana* Bartsch, *Alvania bakeri* Bartsch, *Onoba asser* Bartsch and *Leptogyra alaskana* Bartsch, are new. It is an unfortunate fact that of each of these new species except the *Leptogyra*, I secured only a single specimen, and of the *Leptogyra* I found only half a dozen.

List of Shells Collected.

In the following list the species marked Orcas Island were dredged near Orcas Island, Puget Sound, at depths varying from 10 to 30 fathoms. All other points mentioned are in Alaska except Ballard Beach, a point on the Sound just north of Seattle, Washington, and Sucia Island, a small island north of Orcas.

Purpura foliata Mart. (Cerostoma foliatum Mart.). Orcas Island, living and dead, rather common.

Tritonalia lurida Midd. (Ocinebra lurida Midd.). Orcas Island, dead, not common.

Tritonalia subangulata Stearns (Ocinebra subangulata Stearns = Tritonalia michaeli Ford. Orcas Island, a single young specimen, living.

Boreotrophon multicostatus Esch. Orcas Island, two living specimens.

Boreotrophon orpheus Gld. Orcas Island, two specimens.

Boreotrophon tenuisculptus Cpr. Orcas Island, 1 specimen; Port Graham, Alaska, 1 specimen.

Thais (Nucella) decemcostata Midd. (Purpura decemcostata Midd.). Orcas Island; Ballard Beach; Seward, Alaska.

Thais (Nucella) lamellosa Gmel. (Purpura lamellosa Gmel.). Common at all points visited.

Thais (Nucella) lima Mart. (Purpura lima Mart.). Ellamar; Seward; Port Graham.

Thais (Nucella) saxicola Val. (Purpura saxicola Val.). Ellamar.

Thais (Nucella) saxicola emarginata Desh. (Purpura saxicola emarginata Desh.). Ellamar.

Thais (Nucella) saxicola ostrina Gld. (Purpura saxicola ostrina Gld.). Sucia Island, Puget Sound.

Argobuccinum (Priene) oregonense Redf. (Triton [Priene] oregonense Redf.). Orcas Island; Port Graham.

Chrysodomus liratus Mart. Port Graham, 4 large specimens living.

Chrysodomus tabulatus Baird. Orcas Island, common, living and dead.

Buccinum cyaneum Brug. Ellamar.

Alectrion (Tritia) mendica Gld. (Nassa mendica Gld.). Orcas Island.

Marginella (Volutella) pyriformis Cpr. Orcas Island.

Columbella (Nitidella) gouldi Cpr. Orcas Island.

Amphissa corrugata Rve. Orcas Island, common.

Bela fidicula Gld. Orcas Island, 8 specimens living.

Natica clausa Brod. Orcas Island, Port Graham.

Polinices (Euspira) lewisii Gld. (Lunatia lewisii Gld.). Ballard Beach, common.

Polinices pallidus Brod. & Sby. Orcas Island, Ellamar.

Velutina laevigata Fleming. Orcas Island, not rare.

Galerus fastigiatus Gld. Orcas Island, very common on stones and other shells.

Crepidula dorsata Brod. Orcas Island.

Crepidula grandis Midd. Port Graham.

Crepidula navicelloides Nutt. Orcas Island.

Trichotropis cancellata Hds. Orcas Island, common.

Tachyrynchus lacteola Cpr. (Mesalia lacteola Cpr.). Dredged and on shore Orcas Island.

Caecum hemphilli Stearns. Ellamar.

Eulima micans Cpr. Orcas Island.

Turbonilla (Pyrgolampros) alaskana Dall. Orcas Island.

Turbonilla (Pyrgolampros) taylori D. & B. Ballard Beach.

(To be continued.)

ON OPEAS GOODALLI MILLER.

BY H. A. PILSBRY.

The species commonly called *Opeas goodalli* is the most slender and acuminate of the American *Opeas*. Its history has been given in detail in the Manual of Conchology, XVIII, pp. 200–203 (1906), but in common with other authors I overlooked the fact that the name was preoccupied. The species will henceforth be known as *Opeas pumilum* (Pfr.). The references may be found in full in the Manual, but the following synopsis of synonyms may be useful :

Helix goodalli Miller, 1822, not *Helix goodalli* Ferussac, 1821, see Man. Conch., XIX, p. 295.

Bulimus clavulus Turton, 1831, not *Bulimus clavulus* Lamarck, 1822.

Bulimus pumilus Pfr., 1840.

NEW SHELLS FROM THE GULF OF CALIFORNIA.

BY WILLIAM HEALEY DALL.

In sorting and labeling a lot of shells dredged in the Gulf of California near La Paz, in 10–30 fathoms, sandy bottom, the following species were discovered and appear to be undescribed:

Hindsia perideris n. sp.

Shell of about ten whorls, the nucleus smooth white of about two whorls, the subsequent whorls (except the last) slowly enlarging, forming a slender acute spire, the last whorl suddenly larger; sculpture of about six slightly protractive axial ribs, strong and rounded, following each other up the spire in a gently receding spiral, with much wider interspaces, most prominent at the periphery of the whorls, but traceable to the canal; these are crossed between the sutures by six rounded, subequally spaced spiral threads with much wider interspaces (the space between the posterior thread and the suture widest of all), a little swollen where they override the ribs; on the last whorl finer intercalary threads appear, and on the canal are seven or eight stronger, spirally striated cords; aperture subcircular, not lirate within, with a produced, simple peritreme, and behind it a wide, strong, rounded varix over-ridden by the spiral sculpture; canal short, closed when adult, pointed and strongly recurved. The color of the shell is mostly yellowish-white, with a basal and sometimes a sutural brownish spiral band, which shows more or less in the interior of the aperture.

Length of shell 28.5; of last whorl 18; of aperture 5.6; max. diameter of last whorl exclusive of the varix 12.0; including the varix 15.0 mm.

Type U. S. N. Mus., 96658, from 21 fathoms, others from 27 fathoms.

This shell has much resemblance to *Hindsia acuminata* Rve., the

type of the genus, but has a more elevated and slender spire and fewer axial ribs. *H. acuminata* is a Philippine shell.

The genus *Nassaria* of Link was heterogeneous; no type was named. *N. lyrata* Gmelin (S. N., 3494, no. 109) is to my mind quite a different thing from the *Hindsia* of Arthur Adams, based on such species as *H. acuminata*. The former is a reticulate shell without varices, and with an open canal. The latter and its congeners have a strong and prominent terminal varix, a closed canal, when adult, and sculpture more like the *Tritons*. For this reason I propose to revive *Hindsia* for the group to which the name was originally given, although Adams himself later united them.

Cymatium adairense n. sp.

Shell small, with four glassy, smooth nepionic whorls and four and a half subsequent whorls; color of the shell pale brownish, somewhat darker on the prominences; sculpture of about two varices to a whorl, less on the earlier whorls; on the last two whorls the lines joining the varices are nearly at right angles to each other; the portion of the whorls behind the periphery is flattened, thus making the periphery very prominent; upon it between each pair of varices are three prominent nodules; at the corresponding point on the varices is a conspicuous angle, almost a spine, but the remainder of the varical edge is rounded or crenate by the spiral sculpture; the only other axial sculpture is the sharp sulci which cut the spirals; these spirals are numerous, close set, flat, strap-like cords, separated by narrower, sharp grooves and crossed by many subequally spaced sharp axial sulci; these cut the flat surface of the spirals into minute scale-like segments, but where the spirals cross the varices the interspaces widen; canal rather long, recurved, open; aperture rounded, with a nearly entire, projecting peritreme, smooth on the inner lip, with four or five shallow grooves on the inside of the outer lip. Length of shell 33.0; of last whorl 24.0; of aperture 8.0; maximum diameter of last whorl 17.0 mm.

Type, U. S. N. Mus., 214103, from 10 fathoms sand, off Adair Bay; an immature specimen in 10 fathoms off La Paz. The latter had the nepionic shell in perfect condition; it comprises over four whorls with a heavy brown periostracum, which bears three spiral lines from which project very minute tufts of short, hair-like processes.

The species which most nearly recalls this is the *C. gibbosum*

Broderip, which is a much heavier, larger, proportionately wider and more clumsy shell.

Solariella triplostephanus n. sp.

Shell trochiform, with six tabulate whorls; nucleus very minute, glassy, slightly tilted; subsequent whorls flat above, with closely appressed suture; three strong spirals girdle the whorls; one at the shoulder strongly beaded; one at the middle of the whorl minutely undulate, and the third at the suture, simple, and obscured on all the whorls but the last by the suture being laid against it; on the last whorl there may be a few microscopic spiral threadlets between the shoulder and the median spiral; between the anterior spiral and the edge of the umbilicus on the base are six or eight fine-channeled spiral grooves; the cord bordering the funicular umbilicus is coarsely beaded; within the umbilicus are three or more similar but smaller beaded threads; axial sculpture consisting of fine, sharp, uniform and closely set elevated lines corresponding with the lines of growth, but frequently more or less obsolete; aperture nearly circular, oblique, with simple edges, hardly interrupted on the body; throat pearly. Height of shell 5.25; of aperture 2.5; maximum diameter of shell 7.0 mm.

Type, U. S. N. Mus., 97001, in 12 fathoms sand.

The colors of this pretty little shell are yellowish-white, with flames, dots or blotches of lilac or purple-brown.

TWO NEW MEXICAN LANDSHELLS.

BY WILLIAM H. DALL.

During a recent journey in Mexico Mr. Charles R. Orcutt collected at some hot springs near the Rio Verde, Oaxaca, a number of land shells, which he submitted to me for determination. Two of them appear to be new, and the descriptions follows:

Eucalodium (*Anisospira*) *orcutti* n. sp.

Shell subcylindrical after decollation, of a pale cinnamon brown, weathering to ashy, with 22 whorls, of which about nine are permanent; apical portion flattened above and with three swollen whorls, the nucleus of about $\frac{3}{4}$ of a whorl smooth gradually becoming ribbed with small low clear-cut, nearly straight riblets separated

by wider interspaces, finely spirally striated; after the first three whorls the riblets become closer and slightly arcuately retractive, and the spiral striation obsolete, while the spire is moderately constricted in front of the swollen apical whorls, gradually increases toward the tenth where it rapidly enlarges its diameter; the last two whorls diminish slightly, the base has no carina, but an almost imperceptible thread continues the sutural line, but does not angulate the almost circular aperture. The lip is slightly expanded and thickened, not produced, and with the throat has a light brownish white color. No lamella is visible in the aperture, but at the back of the last whorl a sharp almost vertical plait surrounds the twisted slender axis, and, in the penultimate whorl only, expands to a flat horizontal lamella, while the twist of the pillar assumes the appearance (for about one whorl) of a spiral cord; the rest of the axis shows only a faint twist, and is very slender, though when broken the section reveals a minute perforation. Two extreme specimens measure:

No Whorls.		*Millimeters.*		
Adult.	Apical.	Length.	Max. diameter.	Aperture diam.
10		41.5	12.0	8.0
	13	20.0	6.5	
8.5		39.0	14.0	9.5
	13	20.5	7.5	

U. S. Nat. Mus., No. 212319. Also Orcutt collection.

The shell is about one-third larger than *E.* (*A.*) *hyalina* Pfr., from the same region; its anterior axial lamella is wider and flatter than that of *E.* (*A.*) *liebmanni*: *E.* (*A.*) *townsendi* Pilsbry and Cockerill, is of similar shape, but thinner, and has a much longer lamella.

Epiphragmophora (*Trichodiscina*) *verdensis* n. sp.

Shell of five whorls, whitish, with a brownish, minutely, irregularly, obliquely tufted periostracum; spire depressed with a deep suture and a rounded peripheral keel near the posterior third of the whorl with a marked compression behind it; nucleus small, minutely pustulate, the pustules being modified as the shell grows, into short elevated ridges along the lines of growth, which bear the tufts of the periostracum; beside this the entire shell is minutely punctate; the

base is conically arched toward the margin of the deep umbilicus; the whorl near the aperture is bent down and the plane of the aperture forms an angle of about 45° with the axis; the whorl is slightly contracted behind the thin expanded margin of the aperture, which is continuous in the adult across the body whorl and slightly overshadows the umbilicus; the lip is whitish. Extremes measure:

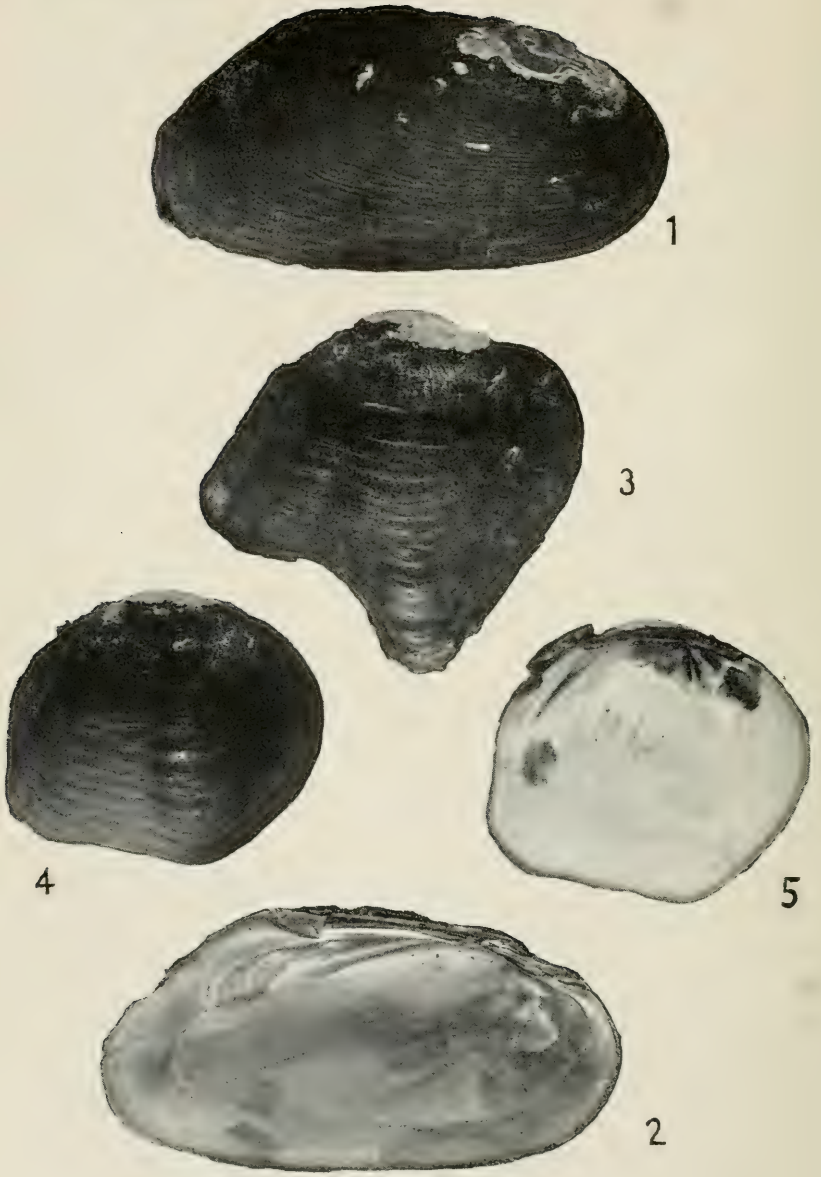
Max. diam. of shell;	of aperture;	height;
15.0	9.0	8.0
16.5	8.5	7.7

U. S. Nat. Mus., No. 212318. Also Orcutt collection.

This is very distinct from the other species of the *Trichodiscina* group.

PUBLICATIONS RECEIVED.

NOTES ON THE GENERA CYPRÆA AND TRIVIA. By H. O. N. SHAW. (Proc. Mal. Soc., London, VIII, 288, 1909.)—An interesting paper treating on the nomenclature and anatomical differences between *Cypræa and Trivia*. The latter has a more specialized nervous system and distinct radula. The following are some of the changes in nomenclature which have been considered: *Cypræa intermedia* becomes a synonym of *gillei* Jouss. *C. reticulata*, *histrio* and *eglantina* are also considered varieties of *C. arabica*. *Cypræa bicolor*, *comptonii*, *declivis* and *piperata* are considered only variations of *C. angustata*. *C. cruenta* Gmel. is not the *cruenta* Auctorum, but equals *errones* L.; under these circumstances he adopts the name of *variolaria* Lam. For the recent *C. physis* the original name of *C. achatidea* Sowb. is adopted. For *C. punctulata* Gray, not Gmelin, the name of *robertsi* Hildago must be accepted. The name of *C. friendii* Gray has priority over *scottii* Gask. *C. tubescens* is only a synonym of *teres*. *C. ursellus* Auctorum, not Gmelin, = *C. Melvilli* Hildago. *C. pantherina* Dillw., 1817, becomes a variety of *obutusa* Perry, 1811. *C. prestoni* is proposed for *interrupta* Gray, not Bolten. *C. hidalgoi* for *leucostoma* Gask., not Gmel. *C. gumbiensis* for *nebulosa* Kiener, not Gmel. *Trivia edgari* is proposed for *T. grando* Gask, not Potiez. For *T. oniscus* Lam., not Bolten, the name of *T. aperta* Swains must be retained. Four new varieties are described: *Cypræa helvola* var. *callista*, *C. moneta* var. *aurea*, *C. arabica* var. *prasina*, and *Trivia ovulata* var. *rubra*.—C. W. J.



WALKER: NEW SPATHA AND TRUNCILLA.

The Nautilus.

Vol. XXIV. AUGUST, 1910. No. 4

PURPURA CRISPATA AND SAXICOLA.

BY E. G. VANATTA.

In the following notes I follow Dr. W. H. Dall in using the generic term *Thais* in place of the familiar name *Purpura*.

THAIS PLICATA Mart.

The species usually called *Purpura crispata* from the west coast of America was first named *Buccinum plicatum* Martyn 1789. The figures in Martyn's Univ. Conchology, pl. 44, represent the *large foliated form*, one being brown with white shoulder, and the other all brown. *Buccinum lamellosum* Gmel. 1790, and *Buccinum compositum* (Chem.) Desh. 1843, were based on the same figures or copies of them. *Polyplex rugosus* Perry 1811, is also the brown form with white shoulder. *Buccinum crispatum* Dillw. 1817, and *Murex ferrugineus* Esch. 1829, are *entirely brown*. *Murex lactuca* Esch. 1829 (not Bolt.), is the *white* form of this species.

T. p. VAR. SEPTENTRIONALIS Rve., Conch. Icon. (Purpura) III, pl. 10, f. 50, is a name for the rather high spired forms without the longitudinal foliation.

THAIS LIMA Mart. 1789.

Buccinum lima Martyn, Univ. Conch., pl. 46, has many spiral costæ. It has the following synonyms: *Purpura canaliculata* Desh. 1839, *Purpura attenuata* Rve. 1846, *Purpura decemcostata* Midd. 1849, *Purpura analoga* Fbs. 1850 and *Purpura beringiana* Midd. 1851; the latter name is for specimens with the costæ more spaced.

THAIS EMARGINATA Desh. 1839.

Purpura emarginata Desh. Rev. Zool. 1839, p. 360, has usually

been called *Purpura saxicola* Val. which is based on figure 4 of plate 8, Voyage of Venus, 1846, which seems to represent *Purpura freycinetii* Desh. 1839 (from Japan). The name *Purpura emarginata* Desh. 1839, is based on the *short spired rather rough surfaced* form of this species. *Purpura conradi* Nutt. (MSS.), Smiths. Misc. X, pl. 83, Tryon, Manual Conch. II, p. 175, seems to be this form, from specimens received from Mr. Nuttall. *Purpura fuscata* Forbes 1850, applies to the specimens with rather *high spire* and many *spiral costæ*, while *Purpura ostrina* Gld. 1852, is the small, *short spired, smooth* form.

Mr. J. G. Malone, of Portland, Oregon, having presented the Academy of Natural Sciences of Philadelphia with a set of these west coast shells, the preceding revision of the nomenclature was undertaken.

A NEW SPATHA.

BRYANT WALKER.

Spatha kamerunensis, n. sp. Pl. III, figs. 1 and 2.

Shell oblong-ovate, somewhat inflated, subsolid; beaks eroded, but apparently only slighty elevated, sculpture not observed, placed about $\frac{1}{5}$ of the total length from the anterior end: anterior end regularly rounded; basal and dorsal lines nearly parallel, slightly diverging posteriorly; basal line nearly straight, in some specimens slightly arcuate; dorsal line straight or slightly curved; dorsal slope oblique; posterior end somewhat prolonged and regularly rounded; posterior ridge rounded, exhibiting in some specimens, a subobsolete angle, terminating at the lower end of the dorsal slope; dorsal slope sculptured with fine, radiating ridges, curving upwards towards the hinge; surface of the disk subsulcate with strong lines of growth, cut by very fine, impressed, radiating lines, between which the epidermis is minutely and irregularly wrinkled or festooned; epidermis very dark brown, almost black towards the margins; hinge edentulous; beak cavity shallow, with a single, deep, dorsal cicatrix directly under the beak; at the posterior end of the ligament, there is a triangular notch in the dorsal border of the nacreous area; impressions of the adductor muscles large, well marked, irregularly oval; that of protractor pedis reniform, situated slightly behind and at the base of that of the anterior adductor; posterior adductor impression large,

oval; that of the posterior retractor small, elongated-oval, separate from that of the posterior adductor and situated immediately below the notch at the end of the ligament; nacre dark, dull plumbeous, tinged with green, more intense towards the beak cavity; scarcely iridescent posteriorly.

Length (of type) 69; height 35½; diam. 22 mm.

Types (No. 30902 Coll. Walker) from the Kribi River, 17 miles from Efulen, Kamerun. Cotypes in the collections of the Univ. of Mich., the Philadelphia Academy, the Carnegie Museum, and Dr. Louis Germain of Paris, France.

Ten specimens, in alcohol, of this very distinct species were sent by Mr. George Schwab to the museum of the Univ. of Mich., to whose curator, Dr. A. G. Ruthven, I am indebted for specimens for description.

By reason of its sculptured surface, it evidently belongs to the subgenus *Aspatharia* Bgt., as recognized by Simpson (1900) and Germain (1909).

In size, shape and in the peculiar sculpturing of the surface, which requires the use of a lens to develop the detail, it is easily distinguishable from both of the allied species.

Fearing that it might be included among the many new species recently discovered by the French naturalists, I submitted a specimen to Dr. Louis Germain of the Museum of Paris, the well-known expert on African Naiades, and am assured by him that it is entirely distinct from any of the described species.

Dr. A. E. Ortmann of the Carnegie Museum, who is making a special study of the anatomy of the Naiades, has kindly prepared the accompanying description of the soft parts.

THE SOFT PARTS OF SPATHA KAMERUNENSIS WALKER.

BY DR. A. E. ORTMANN.

I am obliged to Mr. Bryant Walker for sending me a complete specimen of the new species of *Spatha*, and the soft parts of two others, for examination. The specimen with shell proved to be a male; one of the other two was a sterile female, while in the third the gills were in too poor condition (crushed and torn), so that no attempt was made to ascertain the sex.

The following are the essential characters of the anatomy.

Anal opening closed above by the union of the inner edges of the mantle, *without leaving a supraanal opening.* The upper, closed portion is rather long, over 1½ times as long as the anal opening. The latter is rather large, about as large as the branchial opening, *separated from the branchial opening by the solid union of the inner mantle edges.* Inner mantle edge of anal opening smooth, that of the branchial opening with rather small papillæ. In front of the branchial opening, the inner mantle edges are unconnected and smooth.

Palpi longer than wide, with curved lower edge, posteriorly with a short truncation, but *not produced into a point*, and not connected.

Gills long and narrow, the inner the wider. Outer gill becoming gradually lower anteriorly, and ending at a point behind and above the posterior end of the palpi (at the highest point of the mantle attachment line). Inner gill hardly lower anteriorly, and *its anterior insertion fills the entire space between the anterior end of the outer gill and the palpi*, so that there is no gap between the posterior end of the inner palpus and the anterior end of the inner gill. Edge of inner gill with a longitudinal furrow, that of the outer gill without this furrow. Outer lamina of outer gill entirely connected with the mantle. Inner lamina of inner gill free from the abdominal sac, except at its anterior end; posteriorly, behind the foot, the two inner laminæ of the inner gills are entirely connected, thus forming the larger anterior part of the diaphragm. All four gills *fall short of the posterior mantle edge, and the posterior continuation of the diaphragm is formed by the bridge uniting the mantle edges*, which, from the mantle edge, extends to a certain distance forward (or inward). This bridge, the mantle part of the diaphragm, is rather short; in the dissected female, the soft parts of which are about 68 mm. long, it is 4 mm. long, while the gill part of the diaphragm is much longer, about 29 mm.

Water tubes of both gills well developed, rather regular and quite distinct from base to edge of gill, but rather wide, and the septa are remote from each other. The latter are heavy and strong; in the male they are similarly developed in both gills, and represent simple lines of union of the tissue of the two laminæ, generally with a large blood vessel in the middle. In the female, the structure of the outer gill is identical with that of the male; but *the inner gill alone is*

marsupial: the septa are more strongly developed, but keep about the same distance from each other as in the male; they are longer in the transversal direction, and possess, at their insertion at the outer lamina of the gill (primary limb) *a marked swelling*, within which generally the blood vessel is located.

The structure of the soft parts of this species of *Spatha* is remarkable for the following *six* particulars.

1. The complete absence of a supraanal opening.
2. The separation of the anal and branchial opening by a bridge formed by the mantle.
3. The contact of the anterior insertion of the inner gill with the posterior insertion of the inner palpus.
4. The absence of a posteriorly produced point of the palpi.
5. The marsupium, which is restricted to the inner gills.
6. The peculiar shape of the septa of the marsupial gill.

Among *North American* shells, I have observed a similar absence of the supraanal opening only in *Lampsilis parva* (Barn.), but this is a secondary modification: is not always present, and all the related forms have such an opening. In *Margaritana* and certain species of *Quadrula* (*Rotundaria*), where a supraanal is also absent, the mantle edges have no tendency to close the anal above, and thus represent another type of structure. With these exceptions, *I have never seen any one of the above characters in any species of North America.* There is always a distinct supraanal opening; the separation of the anal and branchial openings is never formed by the mantle edge, and the diaphragm consists of the gills alone; the anterior insertion of the inner gill is always more or less, generally widely, separated from the posterior insertion of the palpi; the palpi are always drawn out into a posterior, projecting point, and are more or less falcate; and the marsupium is never in the inner gill alone, but either in both gills or in the outer one. As regards the shape of the septa of the marsupial gill, it is unlike anything I have seen in North American forms. Unfortunately I cannot tell how far this shape changes in the gravid females, but I think, that the swelling of the gill, when charged, will not be very considerable.

It is clear, that these are very important differences. Simpson (Pr. U. S. Mus. 22, '00, pp. 515 and 895) places *Spatha* in the family *Mutelidæ*, the chief characters of which are the hinge teeth, which, when present, are taxodont, and the shape of the embryo,

which is a lasidium. In *Spatha* there are no, or hardly any, hinge teeth, and they are surely *not* taxodont. The embryo is unknown to me. Yet the above characters of the soft parts fully justify the separation of this genus from the North American *Unionidæ*, and I do not hesitate to affirm, that *Spatha* should stand in a different family, which may be called *Mutelidæ*, if the genus *Mutela* should prove to be allied in the structure of the soft parts. Whether the other genera placed by Simpson in this association actually belong here, remains to be investigated.

DESCRIPTION OF A NEW SPECIES OF TRUNCILLA.

BY BRYANT WALKER.

TRUNCILLA LEWISII n. sp. Pl. III, figs. 3, 4, 5.

Male shell quadrate, subcompressed; thick, solid; dark reddish-yellow, with faint, radiating lines of green; beaks laterally compressed, eroded, but apparently only slightly elevated above the hinge-line, sculpture not seen; anterior end regularly rounded, forming an obtuse angle at its junction with the basal emargination, which is nearly straight; dorsal line curved; posterior end slightly emarginate and terminating in a broad biangulation, which projects slightly beyond the posterior and basal lines; a broad, flat groove extends from the beaks to the basal emargination, widening and deepening as it approaches the base; posterior ridge prominent, rounded towards the beak, but becoming flattened and obsoletely biangulated as it approaches the posterior end; immediately in front of the median groove, there is a strong anterior ridge, which becomes more pronounced as it approaches the base, where it terminates in the angle at the anterior end of the basal emargination, it is more or less roughened by the accentuation of the lines of growth, which elsewhere on the disk are not very strongly developed; dorsal slope concave behind the posterior ridge; interdentum rather long, narrow, rounded and parallel with the hinge; pseudo-cardinals in the left valve, two, the anterior very narrow, straight, directed obliquely forwards and slightly widening towards the anterior end, the posterior triangular, the space between them triangular and extending to the hinge; in the right valve, two, the anterior smaller, but well developed, the posterior long, triangular, the space between them

narrow, direct and extending to the hinge-line, the posterior tooth is separated from the interdentum by a deep groove; lateral teeth bent obliquely downward from the hinge-line, two in the left valve and one in the right, large and nearly straight; anterior adductor impressions large and deep, those of the protractor-pedis well marked, rather long and narrow, below and slightly behind the adductor; anterior retractor impressions small and on the base of the pseudocardinal; posterior adductor impressions large, semicircular; those of the posterior retractors small, but well impressed, above that of the adductor and immediately below the end of the lateral tooth; cavity of the beaks shallow; nacre white.

The female shell is thinner than that of the male and proportionately wider, the posterior ridge being more oblique and more extended; the posterior line is straight or slightly curved, without the emargination noted in the male; the anterior ridge is greatly produced beyond the basal line in a triangular prolongation and this, the marsupial expansion, is of a different texture from the rest of the shell, being thin and dark green as in *T. capsæformis;* between this expansion and the posterior ridge, the base is deeply emarginate.

Length (male) 43; height 37; diam. 22½ mm.

Length (female) 51; height 49½; diam. 25 mm.

Types (No. 15612 Coll. Walker), from the Holston River, Tenn. (ex Lewis Coll.). Also from the Clinch River, Tenn. (Lewis); Cumberland River, Port Burnside, Ky. (Wetherby) and the Holston River, Knox Co., Tenn. (Andrews).

This species, while closely related to *T. foliata* Hild., to which it was referred by the original collectors, is clearly distinct. *Foliata* is a much larger and heavier species and is apparently confined to the Ohio and Wabash rivers, while *lewisii* is restricted to the Cumberland and Tennessee drainage systems, and from all the localities given above is remarkably consistent in its peculiar features. Besides being uniformly smaller, more delicate and smoother than *foliata*, it is specially characterized by the difference in the marsupial expansion, which is triangular and comparatively narrow at the extremity and of a different texture from the body of the shell. In *foliata*, this expansion is broadly rounded and is of the same texture as the remainder of the valve.

It is named in memory of the late Dr. James Lewis, of Mohawk, N. Y. (whose collection has furnished the types), who was a con-

chologist far in advance of his contemporaries and through whose endeavors, a very large part of the fauna of Eastern Tennessee was first made known.

SHELL COLLECTING IN PUGET SOUND AND ALASKA.

BY DR. FRED BAKER, SAN DIEGO, CAL.

(*Concluded from p. 31.*)

Turbonilla (Strioturbonilla) vancouverensis Baird. Orcas Island.

Odostomia (Evalea) cookeana Bartsch. sp. nov. Ellamar.

Odostomia (Evalea) amchitkana D. & B. Ellamar.

Odostomia (Amaura) avellana Cpr. Shore, Orcas Island.

Odostomia (Evalea) deliciosa D. & B. Ballard Beach.

Odostomia (Evalea) inflata Cpr. Orcas Island.

Odostomia (Evalea) valdezi D. & B. Orcas Island.

Littorina groenlandica Mörch. Seward.

Littorina scutulata Gld. All points visited except Port Graham.

Littorina sitchana Phil. All points visited.

Lacuna porrecta Cpr. Orcas Island, Sucia Island.

Lacuna solidula Lovén. Ellamar.

Lacuna vincta Mtg. Ballard Beach, shore Orcas Island, Ellamar.

Bittium (Stylidium) eschrichtii Midd. Dredged and on shore, Orcas Island.

Alvania bakeri Bartsch. sp. nov. Port Graham.

Onoba asser Bartsch. sp. nov. Port Graham.

Mölleria quadræ Dall. Port Graham.

Calliostoma annulatum Mart. Orcas Island, rather common.

Calliostoma costatum Mart. Dredged and on shore Sucia and Orcas Island.

Calliostoma variegatum Cpr. Orcas Island, 4 fine live specimens.

Margarites albulus Gld. Port Graham.

Margarites lirulatus Cpr. Shore, Orcas Island.

Margarites pupilla Gld. Ballard Beach, dredged and on shore, Orcas Island.

Leptogyra alaskana Bartsch. sp. nov. Port Graham.

Haliotis kamtschatkana Jonas. Near Ketchikan, Alaska. (Purchased.)

Puncturella cooperi Cpr. Orcas Island.

Puncturella noachina galeata Gld. Orcas Island.

Acmaea mitra Esch. Port Graham.

Acmaea pelta Esch. Shore Orcas Island, Seward, Ellamar, Port Graham.

Acmaea patina Esch. Ballard Beach, Orcas Island, Ellamar, Seward.

Acmaea patina scutum Esch. Ballard Beach, Orcas Island, Ellamar, Seward.

Cryptobranchia concentrica Midd. Orcas Island, Ellamar, Seward, Port Graham.

Lepidopleurus cancellatus Sby. Port Graham.

Tonicella lineata Wood. Orcas Island, Ballard Beach, Ellamar, Seward.

Tonicella submarmorea Midd. Orcas Island, 1 young specimen.

Ischnochiton interstinctus Gld. Orcas Island.

Ischnochiton mertensii Midd. Orcas Island.

Ischnochiton (Radsiella) trifidus Cpr. Orcas Island.

Trachydermon excelsus Gld. Port Graham.

Trachydermon albus Linn. Port Graham.

Trachydermon raymondi Pilsbry. Ellamar; Port Graham.

Mopalia acuta Cpr. Ellamar.

Mopalia ciliata Sby. Orcas Island.

Mopalia muscosa Gld. Ballard Beach.

Mopalia muscosa hindsii Rve. Orcas Island.

Mopalia muscosa lignosa Gld. Orcas Island; Ballard Beach.

Cryptochiton stelleri Midd. Shore Orcas Island.

Tornatina eximia Baird. Orcas Island, a single specimen.

Cylichna alba Brown. Ellamar, a single specimen.

Haminea vesicula? Gld. Shore Orcas Island, a single specimen.

Dentalium rectius Cpr. Orcas Island, taken in only one dredge haul.

Saxicava arctica Linn. Port Graham; Ellamar.

Mya arenaria Linn. Orcas Island, an introduced species.

Mya arenaria alaskana Dall. Orcas Island, a single young specimen; Port Graham, dead.

Mya truncata Linn. Orcas Island, 3 valves.

Cryptomya californica Conr. Ellamar.

Pandora (Kennerlia) filosa Cpr. Orcas Island, not rare.

Pandora (Kennerlia) grandis Dall. Orcas Island, 4 living specimens.

Pandora (Clidiophora) punctata Cpr. Ellamar, young.

Lyonsia californica Conr. Orcas Island, single valve.

Agriodesma saxicola Baird. Orcas Island.

Mytilimeria nuttalli Conr. Orcas Island, very large specimens in masses of the common Tunicate—Cynthia haustor.

Mactra (Spisula) alaskana Dall. Cordova; Alaska and Ellamar.

Schizothaerus nuttalli Conr. Shore Orcas Island, very large; Ellamar.

Tellina (Angulus) buttoni Dall. Ballard Beach.

Moerella salmonea Cpr. Ballard Beach.

Macoma balthica Linn. Orcas Island; Ellamar.

Macoma calcarea Gmelin. Orcas Island.

Macoma carlottensis Whiteaves. Ellamar, one young specimen.

Macoma incongrua von Martens. Port Graham.

Macoma inconspicua Brod. & Sby. Orcas Island; Ballard Beach; Ellamar.

Macoma inflatula Dall. Orcas Island.

Macoma inquinata Cpr. Orcas Island; Sucia Island; Ellamar.

Macoma leptonoidea Dall. Orcas Island.

Macoma nasuta Conr. Ballard Beach; Shore Orcas Island, very common.

Macoma secta Conr. Ballard Beach.

Saxidomus giganteus Desh. Ballard Beach, shore and dredged; Orcas Island; Ellamar; Port Graham.

Marcia kennerleyi Rve. Orcas Island.

Marcia (Venerella) subdiaphana Cpr. Orcas Island.

Psephidia lordi Baird. Orcas Island; Ellamar.

Paphia (Protothaca) staminea Conr. and varieties. Orcas Island; Sucia Island; Ellamar.

Pisidium occidentale Bourg.? In bogs at an elevation of about 1000 feet on Mt. Constitution, Orcas Island.

Cardium (Cerastoderma) californiense Desh. Orcas Island.

Cardium (Cerastoderma) corbis Mart. All points visited.

Serripes grœnlandicus Gmel. Orcas Island.

Phacoides tenuisculptus Conr. Orcas Island.

Axinopsis sericata Cpr. Orcas Island; Ellamar.

Erycina compressa Dall. Ellamar, dead on shore.

Erycina rugifera Cpr. Orcas Island. All specimens taken were attached to the ventral surface of the so-called Sea Mouse, Aphro-

dita. It has been reported as growing on Gebia pugetensis, a burrowing crustacean, but so far as I know, no report has been made of this habitat. About a quarter of the specimens taken had one or more of the mollusks attached.

Lepton meröeum Cpr. Orcas Island.
Kellia laperousii Desh. Orcas Island, Ellamar.
Kellia suborbicularis Montagu. Ellamar.
Rochefortia aleutica Dall. Port Graham.
Rochefortia tumida Cpr. Ballard Beach.
Turtonia minuta Mont. Ellamar, Port Graham.
Astarte alaskensis Dall. Orcas Island.
Astarte rollandi Bernardi. Port Graham, very common.
Venericardia ventricosa Gld. Orcas Island.
Nucula belloti A. Ad. Orcas Island.
Yoldia ensifera Dall. Orcas Island.
Yoldia limatula Say. Orcas Island.
Yoldia thraciæformis Storer. Orcas Island.
Glycimeris subobsoleta Cpr. Orcas Island.
Mytilus edulis Linn. All points visited.
Modiolus capax Conr. Orcas Island.
Modiolus fornicatus Cpr. Orcas Island.
Modiolus modiolus Linn. Shore Orcas Island, Port Graham.
Modiolaria laevigata Gray. Orcas Island.
Modiolaria vernicosa Midd. Ellamar.
Pecten (Patinopecten) caurinus Gld. Orcas Island, 8 living and several valves.
Pecten (Chlamys) hastatus Sby. Orcas Island.
Pecten (Chlamys) hastatus hericus Gld. Orcas Island.
Pecten (Chlamys) hastatus hindsii Cpr. Orcas Island.
Pecten (Chlamys) hastatus navarchus Dall. Orcas Island.
Monia macrochisma Desh. Orcas Island.
Terebratalia transversa Sby. Orcas Island.

NOTES ON DAVISIA AND MALVINASIA.

BY WM. H. DALL.

In the Annals and Magazine of Natural History for January, 1910, Messrs. J. E. Cooper and H. B. Preston described two supposedly new genera of minute bivalves from the Falkland Islands. Through

the courtesy of Mr. Preston and the great kindness of M. Philippe Dautzenberg of Paris, who had purchased the types of these genera, I have been able to examine them under the compound microscope and determine their hinge characters. These very minute bivalves are exceedingly difficult objects of study, and unless one is familiar with the type of hinge possessed by them it is very difficult to detertermine their true characters.

I find *Davisia* to possess exactly the type of hinge figured by Bernard for "*Erycina*" *veneris* Mun. Chalmas and Velain, in Bull. Mus. d'hist. Nat. de Paris, 1898, p. 81, fig. 3. This is not an *Erycina* in the proper sense, as Bernard points out, but is very closely related to *Kellia* as typified by *K. suborbicularis*. If examination of other species should show that the small differences which exist are constant, the group might rank as a section of *Kellia*.

Malvinasia on the other hand is based on a normal species of *Rochefortia* (see Bernard, *op. cit.*, p. 82, fig. 4).

I may in this connection recall that another supposed new genus of Leptonacea, *Diplodontina* Stempell, 1899, from Chile, has the hinge of *Kellia* and is probably a member of the latter genus.

NOTES.

SHALL WE BE ORDERED OFF THE BEACHES?—There already exists a trust or combination which controls the trade in food fishes, and I suspect that there are those who would like to extend the same system to the mollusks. At least I have just seen a book called "Shell-fish Industries," by Prof. James L. Kellogg, which, mingling data about edible mollusks with some ordinary politicians' talk or "buncombe" about the superiority of American to European institutions and the like, appears to be put out to promote the passing of laws which would facilitate the monopolization of our mollusks. It recommends handing over our beaches and mud-flats to private landlords or sealords. Most shell collectors have been annoyed by attempts to exclude them, by means sometimes legal sometimes illegal and fraudulent, from access to sea, rivers or lakes, and will not be pleased to find a professed naturalist working to deprive them of any right to collect marine mollusks except in deep water with a dredge. For example, while collecting at Nahant, Massachusetts, between tides, I have been told to get out by a minion of an adjacent landowner, notwithstanding that I had a legal right to be there, although I would no longer have it under the laws proposed by this book.—JOHN A. ALLEN.

THE NAUTILUS.

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SOME NOTES ON THE OLIVIDAE.

BY CHARLES W. JOHNSON.

I.

Perhaps no group of shells presents such a great variation of color as occurs in many species of the genus Oliva. In trying to define the true relative position of the various forms, two conditions act as impediments—the confusion in nomenclature and the lack of positive localities for the species. Localities for species are frequently cited which are undoubtedly erroneous. That many of the forms represent only local races is apparent from the fact that where specimens have a positive habitat within the range of a species, there is as a rule an apparent uniformity of the specimens which readily distinguishes them from others. This can perhaps be reasonably accounted for when we take into consideration their distribution and habits. Chiefly tropical and living on the sandy shores and bars of the more sheltered and shallow waters of the gulfs and bays, their distribution is necessarily restricted, thus creating environmental conditions, favorable for numerous local variations. The necessity for studying the species faunologically is therefore evident, and if monographers had done so, a much clearer idea of the relationship of species and the range of specific variation would have been attained.

Tryon's views as to synonomy are most excellent, the chief fault of his work being his disregard of priority, even of the Lamarckian species. The excellent and numerous figures by Marrat (Sowerby's Thesaurus Conchyliorum, vol. iv) illustrate practically all important

variations, which was the author's intention rather than to define the species, although many of these are treated as species. His species credited to Martini and Meuschen will have to be ignored, but those of Bolten will stand.

I have been led to write these notes in connection with my attempt to list the collection of the late John Ford. In making comparative studies I have also used the collection of the Boston Society of Natural History, thus having large series of all the more variable species. With the combined collections, I have before me over 250 specimens referable to the following species and varieties.

Oliva sericea (Bolten).

Porphyria sericea Bolten, Mus. Boltenianum, p. 33, 1798.

Oliva textilina Lam., Ann. du Mus., p. 309, 1810. Bolton's and Lamarck's species are both based upon the same recognizable figure by Martini (Conch. Cab. II, tab. 51, fig. 559). Bolton's being the first name proposed will have to be adopted, as was done by Marrat. Why Tryon should have chosen the doubtful *irisans* described on page 310 instead of *textilina* on page 309, making the latter a variety of the former is hard to understand. Lamarck's first figure referring to *irisans* is that of Martini (Conch. Cab., fig. 561). He again refers to the same figure under *reticularis* (Ann. du Mus., xvi, p. 314). Bolten refers to the same figure (561) as a second example of *sericea*, evidently considering it the young of that species. One feels doubtful as to the identity of this figure; unbiased I should have referred it to a light-colored *sanguinolenta*. The second figures referred to by Lamarck are those given by Chemnitz (Conch. Cab., x, tab. 147, figs. 1371, 1372). This reference is followed by a question mark. The latter figures certainly do not belong to this variable species, but possibly to a form of *elegans*. Both Weinkauff and Marrat seem to have selected the callous spired forms of *zeilanica* as the representative of Lamarck's *irisans*. As the callus spire is not mentioned in the original description or shown in the figures referred to, they are evidently in error, as was pointed out by Ford when describing *cryptospira* (Proc. Acad. Nat. Sci., 1891, p. 98).

It is probable that the progenitor of all the forms of this variable species is *tremulina* from which diverge three well-marked varieties with a number of parallel variations connected by intermediate forms, but the rules of priority compel the adoption of one of the extreme variations.

Variety *tremulina* Lamarck.

Oliva tremulina Lam., Ann. du Mus., XVI, p. 310, 1810.

This is well shown by Marrat on plate 8, fig. 117. It is in every respect like *miniacea* except that the aperture is white or bluish white; *fumosa* Marr. is only a dark form. The var. *pica* Lam. (*nobilis* Reeve + *concinna* Marr.) is more or less coarsely and irregularly marked with dark brown, but forms are before me representing all intermediate stages between *tremulina* and the var. *tenebrosa* Marr. in which the dark brown covers the entire shell.

Variety *miniacea* (Bolten).

Porphyria miniacea Bolten, Mus. Boltenianum, p. 33, 1798.

Oliva erythrostoma Lam., Ann. du Mus., XVI, p. 309, 1810.

Both authors again refer to the same figures by Martini (Conch. Cab., II, tab. 45, figs. 476, 477). Distinguished from *tremulina* in having the aperture a bright orange red. Intermediate forms connect it with a uniform dark brown form similar to *tenebrosa*, see Thes. Conch., IV, pl. 7, fig. 109 (var. *marrati* n. var.). On the other hand the shells become gradually lighter in color and abnormally thickened, representing the var. *ponderosa* Duclos. The latter seems to be the characteristic form of Mauritius and adjacent islands.

Variety *zeilanica* Lamarck.

Oliva zeilanica Lam., Anim. sans Vert.; VII, p. 436, 1822.

This represents a smaller race quite readily separated in the adult but completely connected with *tremulina* in younger specimens. In other words it does not go beyond this juvenile appearance even in the adult. This view is strengthened by the fact that it also shows a parallel variation in color. There is however a variation which is apparently peculiar to this race, which consists of the spire in the adult becoming covered by a callus. Three specimens that would otherwise be typical *zeilanica* show this feature. This gradually merges into a lighter colored form, often with a violet-colored aperture constituting the var. *ornata* Marr. A light yellow form with only a slight trace of the markings constitutes the var. *cryptospira* Ford, which merges into a dark brown form resembling *tenebrosa*, see Thes. Conch., IV, pl. 9, fig. 126 (var. *fordi* n. var.). These varietal names are given merely for convenience in referring to these extreme forms.

SOME NOTES ON PYRAMIDELLID NOMENCLATURE.

BY TOM IREDALE.

The study of Pyramidellid Mollusks is attended with great difficulty, and systematic treatment of the family has not been attempted within recent years until the investigation of American forms was undertaken by Messrs. Dall and Bartsch. Great praise is due to their efforts which have been crowned by the publication of a Synopsis of the Genera, Subgenera and Sections of the family Pyramidellidæ. This is included in their Monograph of West American Pyramidellid Mollusks (Bull. U. S. Nat. Mus., No. 68, 1909) and inasmuch as the preface includes the remark "In all cases the synonymy of group names adopted has been based on researches which began with the typical species of the original authors," one would expect exact quotations. It is deeply to be regretted that in the preparation of the Synopsis due care was not given to the verification of the introduction of the divisional names chosen. As a consequence errors have been perpetuated and workers in remote localities will now further add confusion. To such, on account of lack of literature, are denied the means of verification, and the data provided by Messrs. Dall and Bartsch will be copied without criticism. The practical value of the work done by Messrs. Dall and Bartsch is immense, and there can be no doubt that their conclusions will in the main be unquestionably accepted. It is much against my will that I should have to point out blemishes regarding their quotations of literature. However it is only by means of criticism that we can hope to attain completeness, and I herewith indicate a few errors in the hope that when the East American Pyramidellid mollusks are monographed a revised and corrected Synopsis will be included. All the references to Dall and Bartsch in the succeeding notes are to the paper above mentioned.

Actæopyramis Fischer.

On p. 17—*Monotygma* Gray. Syn. Brit. Mus., 1840. I note this only to point out that in the Synopsis of the British Museum, 1840 and 1842, lists of nude generic names are given by Gray, and though often quoted these have no scientific value as of that place. No indication whatever appears as to species.

Eulimella.

Dall and Bartsch, on p. 10, write

Subgenus *Eulimella* Forbes, 1846 (6).

Type, *Eulimella crassula* Forbes = *E. scillæ* Scacchi.

On p. 17 is found the familiar quotation

(6) *Eulimella* Forbes, Ann. Mag. Nat. Hist., Vol. 14, 1846, p. 412. This reference appears to have been introduced into literature by Hermannsen; copied by Scudder it has attained a wide acceptance, two recent users I have noted being Locard (Cat. Moll. Viv. France, 1886, p. 211) and Kobelt (Icon. Schale. Europ. Meeres conchy. Vol. III, p. 161, 1903). Yet two errors appear in it: Vol. 14 was issued in 1844 and there the genus is not introduced; a shell, *Eulima MacAndrei* is described on p. 412 by Forbes.

The first introduction of *Eulimella* is, as given by Marschall, in the Ann. Mag. Nat. Hist., Vol. XIX, p. 311, 1847, where Jeffreys writes "*Eulimella* (Forbes) *crassula* Mal. and Conch. J. *E. Mac Andrei* Forbes."

The incomplete quotation should read "Mal. and Conch. Mag. pl. I, p. 34, 1838," where Jeffreys listed *Eulima crassula* n. sp. No description was offered and its assignment to Forbes by Dall and Bartsch is incorrect.

In the P. Z. S., 1847, p. 160, Gray wrote

"*Eulimella* Forbes, 1846. . . . *Melania scillæ*. This notice appears to conform with the scant regulation now considered sufficient to carry a generic name so that it would appear that we must quote this genus as of Gray. It may be argued that Jeffreys has precedence and it seems doubtful to me to whom should be given the credit. I prefer Gray's quotation. I have searched throughout Forbes' papers from 1844 to 1847 and have been unable to meet with the name. I conclude it was a MS. name, and in support of this view would cite the Hist. Brit. Moll., p. 308, 1850. There the genus is assigned to Forbes; it is well described, and though full references are appended no notice of the previous occurrence in literature of *Eulimella* is given save the one by Jeffreys. Dall and Bartsch give as a synonym of *Eulimella*, *Loxoptyxis* Cossmann; the paper they quote was included in the Ann. Soc. Roy. Malac. Belg., Vol. XXIII, for the year 1888, p. 99. What year the Annales appeared in I cannot say, but I noticed that on the title page of those for 1896 is printed "Distribué le 24 décembre 1899."

As synonymous also is regarded *Belonidium* Cossmann, Jour. de Conch., Vol. 40, 1892, p. 350. This name appears to have been

overlooked by the compilers of the Zool. Record; it is as well to note that the part of the Jour. de Conch. containing this name was not received at the British Museum until the 10th of May, 1893, as noted in the Jour. Malac., Vol. 3, p. 9, 1894. As type of this genus Dall and Bartsch write "*Aciculina gracilis* Cossmann." Should it not be "*Aciculina gracilis* Deshayes"?

Oscilla.

On p. 17 Dall and Bartsch include this in the synonymy of *Cingulina;* their reference reads "*Oscilla* A. Adams, Idem, 1860, p. 418; type, *Oscilla lirata* A. Adams;" the Idem stands for Ann. Mag. Nat. Hist., 3d Ser., Vol. 6. But at that place *Oscilla* does not occur.

Oscilla is defined in the Proc. Zool. Soc., 1867, p. 310, where five species are included; the first species is *lirata* A. Adams, but the third is *cingulata* A. Ad., which when it was introduced as *Monoptygma cingulata* in the Ann. Mag. Nat. Hist. Ser., III, Vol. VII, p. 296, 1861, was followed by this note. "This species is by no means typical, and should form a subgenus under the name of *Oscilla.*" Consequently *cingulata* A. Ad. must be regarded as the type of *Oscilla*, and the name date from this introduction. There is a group of Pyramidellid mollusks which agree with *cingulata* and the subgeneric definition "*plica parietali, valida, transversa, mediana,*" and though superficially resembling *Cingulina* are shorter, broader shells, and are recognizable as Odostomias rather than Turbonillas. As I can see no group to which they are otherwise referable, I advise the retention of *Oscilla* for these forms: they compose a group quite as natural as any other Pyramidellid group.

Since this note was written I have seen a paper by Hedley (P. L. S. N. S. W., Vol. XXXIV, 1909), wherein are described *Odostomia gumia*, p. 446, pl. XLI, fig. 67, *Odostomia migma.* p. 447, pl. XLI, fig. 70, and *Odostomia loquearia*, p. 447, pl. XLIII, fig. 82. These beautiful figures indicate shells, which from their form I should class as *Oscilla.* They do not look like *Turbonilla.*

Agatha.

Dall and Bartsch at the foot of p. 10 write "The status of *Agatha virgo* A. Adams, 1860 (*Menestho*, 1861, *Myonia*, 1861, *Amathis*, 1861), is not known to us. From the meager description we are inclined to believe that it is allied to *Actaeopyramis* Fischer."

But in the Proc. U. S. Nat. Mus., Vol. 30, 1906, p. 335, pl.

XVIII, fig. 2, the same authors had redescribed and figured this shell accepting *Agatha* as a valid subgenus of Pyramidella. They gave full references and concluded with "*P.* (*A.*) *virgo* A. Ad. is the type of *Agatha;* we do not know why Adams changed this to *Myonia* and *Amathis* as we have been unable to find the name preoccupied."

The references they give provide the solution of their puzzle. When A. Adams described *Agatha virgo*[1] he did not introduce a new genus, as after the description he wrote "may well be regarded as the queen of a genus of which all the species are lovely." This indicates that a genus with a number of species known to him and already described was in his mind. This is confirmed later by the remark "*Myonia virgo* is a third species of *Menestho.*"[2] These two papers were written from Japan, and immediately upon receipt of the first one he corrected the error thus, "generic name should have been *Myonia* not *Agatha.*"[3]

He then introduced *Amathis*[4] and designated as type *Myonia virgo* A. Ad. From the preceding it seems that *Amathis* should be utilized, but a puzzling complication is introduced by the fact that later Adams himself forgot his work and reintroducing *Agatha* remarks "of which *A. virgo* A. Ad. is the type."[5]

De Folin's Names.

De Folin introduced many genera of his family *Chemnitzidæ* and these names are noted in Dall and Bartsch's work. The history of these names as well as the interpretation appears very imperfectly known, and it would have been well had Dall and Bartsch gone carefully into the literature. They appear to have handled the conchological work splendidly, and it is disappointing to have to find fault with their quotations. In a series entitled "Les Fonds de la Mer," which was issued in parts from 1867 onwards and is apparently complete in three volumes, De Folin described a number of Pyramidellids. New generic names were introduced without indication of their novelty.

At the same time De Folin drew up a classification of the *Chemnitzidæ* which was published in the Ann. Soc. Linn. Maine et Loire, Vol. XII, pp. 191 *et seq.*, 1870. This appears to have escaped Dall

[1] Annals, Ser. III, Vol. VI, 1860, p. 422.
[2] *Loc. cit.*, Vol. VII, 1861, p. 295.
[3] *Loc. cit.*, Vol. VIII, 1861, p. 142.
[4] *Loc. cit.*, Vol. VIII, 1861, p. 303.
[5] *Loc. cit.*, Ser. IV, Vol. VI, 1870, p. 127.

and Bartsch's notice. The title of the paper is "D'une Méthode de Classification pour les coquilles de la famille des Chemnitzidæ," and on p. 200 is given a tabular statement of the family where appear the names *Oceanida*, *Salassia*, *Ondina*, *Elodia*, *Odetta* and *Noëmia*. No species are mentioned.

In the Ann. Soc. Agri. et Hist. Nat., Lyons, Vol. VII, 1884 (1885), pp. 209 *et seq.*, De Folin included another paper entitled "Constitution Méthodique rationnelle et naturelle de la Famille des Chemnitzidæ." The tabular statement above mentioned is there reproduced without alteration. A reprint of this paper appears to have been consulted by Dall and Bartsch as they quote it under its title and give pagination agreeing with that conclusion.

I have only had access to the first volume of "Les Fonds de la Mer," which appears to be a scarce work.

In that volume on p. 214 two species are diagnosed as *Ondina sulcata* De Folin and *Jaminea bilirata* De Folin. The part including these names was issued in 1869. On p. 264 *Oceanida graduata* De Folin is introduced. This part appeared in 1870. At the end of this volume on p. 314 a list of new species actually to hand is noted. There is mentioned *Odetta spp*, *Noëmia spp*, *Lia spp*, *Elodia elegans* and *Salassia carinata*. These were probably published in the succeeding volumes. I conclude p. 314 came out in 1871.

With their references to these names Dall and Bartsch have been peculiarly unfortunate, in almost every instance errors having crept in.

First (p. 13) they accept as a valid subgenus "*Elodiamea* De Folin 1884 (26)." Referring to (26) p. 18 we read "*Elodiamea* De Folin, Zool. Record, Vol. 22, 1885, p. 94 = *Elodia* De Folin, Les Méléagrinicoles, 1867, p. 66; type, *Elodia elegans* De Folin, not *Elodia* Desvoidy, 1863; + *Herviera* Melvill and Standen, Journ. Conch., Vol. 9, 1897, p. 185; type, *Pyrgulina gliriella* Melvill and Standen. The Zool. Record for 1885 would not be published until 1886, so that 1884 is obviously incorrect. *Elodia* is not introduced at the place quoted: a species *Eulima elodia* there appears; if that be the same as *Elodia elegans*, then Dall and Bartsch have produced a second complication as they have re-named *elegans* on account of its preoccupation in *Odostomia*.

The Jour. Conch., Vol. 9, p. 185, appeared in 1899 not 1897, and if *Herviera* be a synonym of *Elodiamea*, then the latter is identical with *Odostomella* Bucquoy Dautz. and Dollf. Hedley (P. L. S. N.

S. W., Vol. XXX, p. 525, 1906) has already suggested the identity of *Herviera* with *Odostomella*. Dall and Bartsch wrongly cite this genus as *Odostomiella* and separate it from *Eloidiumea* by characters which seem intangible, as the two species of *Herviera* show features assigned to each.

On p. 134 Dall and Bartsch include as valid *Salassia* De Folin, Const. d. Chemnitzidæ, 1885, p. 15, and then for the type species give the quotation *Salassia carinata* De Folin, Fonds de la Mer, Vol. 2, 1872, p. 168, pl. 6, fig. 6.

This latter would appear to be the quotation for the subgenus. Certainly the former cannot be used as the name appeared under exactly the same conditions in the 1870 paper above noted.

However is not the name preoccupied by *Salassa* Moore, P. Z. S., 1859, p. 246? To divert, on p. 16 is indicated and on p. 133 is diagnosed a new subgenus *Salassiella*. Is not this also preoccupied by *Salasiella* Strebel, Mex. K. Land. u. Suswass. Conch., III, p. 6, 29, 1877?

On p. 16 *Oceanida* De Folin is included as valid and the correct reference is given, but the type species name is misquoted *gradata;* it should be *graduata*. Into synonymy Dall and Bartsch consign the rest of De Folin's genera, *Noëmia*, *Lia*, *Odetta*, *Jaminea*, *Jaminina* and *Ondina*. The first three are all recorded as nude names in Vol. I, p. 314, 1871.

This is quoted for *Noëmia*, p. 136, as Fonds de la Mer, 1873, p. 314.

Lia, p. 176, 1870, p. 515.

Odetta, p. 184, 1870, p. 314.

"*Jaminea* De Folin, Consit. Method. de la Fam. Chemnitziidæ, 1885, p. 15. Type *Jaminea bilirata* De Folin; not *Jaminea* Brown, 1827. + *Jaminina* De Folin, Zool. Record, Vol. 22, 1885, p. 94. Type *Jaminea bilirata* De Folin." This appears in the synonymy of *Menestho* Möller, on p. 184, and seems incorrectly stated. As previously noted *Jaminea bilirata* De Folin was diagnosed in Fonds de la Mer, Vol. I, p. 214, 1869; in the 1885 paper De Folin writes "*Jaminea Brown*," and gives no names of species so that I cannot understand the reason of typifying it as of De Folin. *Jaminina* De Folin does not occur in any copies of the Zool. Record, 1885, p. 94, that I have had access to, and I have been unable to trace it. Of course all the preceding are minute errors but they are, nevertheless, very perplexing if literature is unavailable.

I have noted the following typographical errors:

P.	8, line 22	Scacchi should read Brocchi.	
	11, 22	*plicala*	*plicatula.*
	17, 22	1853	1833.
	18, 20	p. 59	p. 8.
	30	1879	1899.
	29, 3	*plicata*	*plicatula.*
	14	*plicata*	*plicatula.*
	15	*plicatus*	*plicatulus.*

It is interesting to note that these errors are indexed.

On p. 18, line 27 as reference to (41) is given Proc. Royal Soc. Tasmania, 1877, p. 152. The correct quotation is Trans. Roy. Soc., South Australia, Vol. XXIV, p. 98, 1900.

DESCRIPTION OF A NEW LYMNAEA.

BY F. C. BAKER.

LYMNÆA EMARGINATA WISCONSINENSIS nov. var.

Limnæa ampla Whiteaves (not Mighels), Can. Nat. and Geol., VIII, pp. 102, 112, fig. 11, 1863.—Taylor, Ottawa Nat., VI, p. 35, 1892.

Shell very large, varying from elongate to globose, inflated, usually rather thin; periostracum varying from light yellowish horn to chestnut; nuclear whorls as in *emarginata;* sculpture as in *emarginata;* many specimens have, in addition to the spiral impressed lines, a number of heavy, more or less equidistant, spiral ridges encircling the body whorl; the last whorl may also be somewhat malleated; whorls 5 to $5\frac{1}{2}$; globose, roundly shouldered, inflated, the body whorl very globose and disproportionately swollen; spire varying from broadly acute to flatly depressed, usually about half the length of the entire shell; suture well marked, often deeply impressed; aperture roundly-ovate, rarely quadrate, seldom flaring; peristome with internal, varical thickening; inner lip wide, whitish, broadly reflected over the umbilical region producing a wide, flat expansion, which emarginates the umbilical chink, as in the typical form; umbilical chink usually very large and conspicuous; imperforate individuals are rare; the parietal callus is thick and wide producing a continuous aperture in some specimens; the lower part of the aperture is somewhat effuse in a few individuals.

Length, 23.50; breadth, 15.00; aperture length, 13.00; breadth, 7.50 mill.

Length, 22.00; breadth, 15.00; aperture length, 12.00; breadth, 8.00 mill.

Length, 24.00; breadth, 16.00; aperture length, 13.50; breadth, 9.00 mill.

Length, 24.00; breadth, 16.25; aperture length, 13.00; breadth, 8.00.

Length, 26.50; breadth, 19.50; aperture length, 16.50; breadth, 11.00.

Length, 25.00; breadth, 19.00; aperture length, 16.00; breadth, 10.00 mill.

Length, 36.00; breadth, 19.00; aperture length, 16.50; breadth, 10.00 mill.

Types: The Chicago Academy of Sciences, 19 specimens, no. 24504; cotypes, coll. Bryant Walker, Detroit, Mich., and Academy of Natural Sciences of Philadelphia.

Type locality: East shore Tomahawk Lake, Oneida Co., Wis.

Animal: Similar to typical *emarginata*. The animals of the Tomahawk Lake race are of two very pronounced colors, black with white dots and bright yellow with white dots. This difference in the animal is quite conspicuous rendering the light-colored specimens less noticeable than the dark-colored in individuals against the white sand of the shore.

Jaw, Radula and Genitalia: In all respects similar to those of *emarginata*.

Range: Southern Quebec west to Wisconsin.

L. wisconsinensis has been seen from but two places, Brome Lake, Brome District, Quebec (Whiteaves), and Tomahawk Lake, Oneida Co., Wisconsin (Baker). It doubtless lives in many lakes between these two points, and has probably been identified as *L. mighelsi*.

Ecology: In Tomahawk Lake, Wisconsin, this species is very abundant, the shore after storms being literally paved with dead shells. It lives on the sandy or pebbly shores, in water from a few inches to several feet in depth. By wading along the beach thousands may be collected. The localities in this lake are all on exposed points or in curved bays where the shore receives the full force of the waves. No specimens were found in sheltered places, where the water was at all stagnant. As recorded by Dr. Kirtland, for *angulata*, they were irregularly scattered over the surface, crawling over the sand, where a distinct track was left, or else lying half buried in the sand. The two different colors mentioned by Nylander as being characteristic of the Maine *emarginata* were also observed in the Tomahawk Lake specimens.

Remarks: This race differs from all the other races of *emarginata* in its very globose body whorl and rounded aperture. The race is very variable, the variant being the spire which is elongated or depressed. Some individuals approach *mighelsi*, but this is rare, the shell being usually much more globose than that race. *Angulata* differs in having a heavier shell, a much less globose body whorl, and an elongated and angulated, instead of rounded, aperture. The umbilicus is closed in *angulata* while it is usually open in *wisconsinensis*. The globose form will, however, separate this race from all

others. The umbilical chink is usually conspicuous but may be so wide as to form a deep umbilicus or it may be entirely closed, as in some specimens from both Wisconsin and Canada. *L. e. wisconsinensis* is by far the most abundant shell in Tomahawk Lake, Wisconsin, where, in many places, it forms windrows of dead shells on the shore after a northwesterly storm. It was at first thought to be a variety of the *mighelsi* type of shell, but the globular form of the body whorl is so different from *mighelsi* and the shells are so numerous in the original locality as to render it quite as eligible to receive a name as are any of the races of *Lymnœa*.

NOTES.

The Lamarck Collection.—In these days, when systematists pay more attention to ancient authors, it is of the highest importance to know the precise specimens which those authors had before them when they wrote their descriptions, usually almost unintelligible to us, and gave their names. Among the more important systematic works of the early part of the last century is Lamarck's "Histoire Naturelle des Animaux sans Vertèbres." Consequently the specimens on which that work was based are of particular value. On Lamarck's death his conchological collection was bought by Prince Masséna. Some years later it became the property of Mr. Benjamin Delessert, who bequeathed it to the city of Geneva, and it is now preserved in the natural history museum of that place. It contained chiefly shells of mollusks and brachiopods, both living and fossil. It was accompanied by a catalogue based on a copy of the "Histoire Naturelle," and containing marginal notes written either by Lamarck or by the daughter who served as his secretary when he became blind. The Geneva Museum has now undertaken the publication of an illustrated catalogue, giving figures of all the species found in Lamarck's collection, whether created by himself or by other authors. Except in those cases where the species are represented by a very large number of specimens, or sometimes badly preserved specimens, all the specimens will be figured. The accompanying text will give the diagnosis of Lamarck, the number of specimens indicated in his MS. catalogue, and the number now to be found in his collection. Other notes will be added as required. The first part, relating to the fossil brachiopods, has now been issued. It comprises twenty-two plates, and has been drawn up with the collaboration of Dr. M. Clerc and Dr. J. Faire. The complete catalogue will be issued in two series, one representing living species and the other fossil species. It is possible to subscribe to one or other of these series. After publication and distribution to subscribers, the separate sections will be sold at a slightly higher price. Further details may be obtained from Mr. M. Bedot, Directeur du Museum Naturelle, Geneva, or Messrs. Georg et Cie, libraires a Geneva.—From *The Museums Journal*, vol. 9, p. 459, June, 1910.

The Nautilus.

Vol. XXIV. OCTOBER, 1910. No. 6

MOLLUSKS OF UNITY, MAINE.

BY S. STILLMAN BERRY.

Malacologically speaking, as it were, little Waldo county is one of the least known regions in the state of Maine. Although the town of Unity in its extreme northwest corner boasted one of the earliest conchologists of New England, little work appears to have been done since, and in glancing over the pages of Mr. Lermand's "Shells of Maine" we find that eight species and two varieties are all that the author could positively accredit to the county. The early conchologist referred to is one Dr. Milliken who sent his shells to Dr. J. W. Mighels and our present knowledge of them is gained from the lists and in one case (*Lymnæa decollata*) the descriptions of the latter. The present writer has had occasion to spend considerable leisure from time to time in the self-same town of Unity, and it is with the hope of filling in another of the gaps that the following list of mollusks collected is given.

Thanks are due to Mr. Charles W. Johnson for opportunity to compare specimens of *Lymnæa decollata* with some of Dr. Mighels' own specimens and for numerous other kindnesses. I am likewise indebted to Mr. George H. Clapp for aid in determining some of the smaller terrestrial species.

Unio complanatus (Sol.). Abundant in Lake Winnecook, as are also three following species in less degree:

Lampsilis cariosus (Say).

Lampsilis radiatus (Gmel.).

Anodonta marginata Say.

Pisidium. Perhaps half a dozen undetermined species of *Pisidium* were found in some abundance in the lake and in Sandy Stream.

Musculium secure (Prime). Common in pools on "the Intervale."

Campeloma decisum (Say). Winnecook Lake. Common.

Valvata tricarinata (Say). Winnecook Lake. Common.

Valvata tricarinata confusa Walk. Winnecook Lake, one spec.

Amnicola limosa porata (Say). Winnecook Lake and Sandy Stream. By far the most abundant species.

Lymnæa obrussa (Say). Winnecook Lake. Not found in Aug.-Sept., 1909, but common in Apr., 1910.

Lymnæa humilis modicelle (Say). Winnecook Lake. Sept., 1909, rare.

Lymnæa palustris (Müll). Pools on Intervale, Apr., 1910, common.

Lymnæa decollata (Mighels). Abundant in Lake Winnecook, the type locality (especially late in the season), where it was originally collected by Dr. Milliken.

Planorbis bicarinatus Say. Winnecook Lake. One specimen, Aug., 1909.

Planorbis campanulatus Say. Winnecook Lake. Not rare in Sept., 1909.

Planorbis exacutus Say. Winnecook Lake. Two specimens.

Planorbis hirsutus Gld. Common in the lake.

Planorbis parvus Say. With the preceding.

Planorbis parvus elevatus (Adams). Several specimens of a minute *Planorbis* were found in a bit of swamp bordering the lake. All seemed referable to this form rather than to typical *parvus*.

Dr. Milliken found also *P. trivolvis* apparently in some numbers,[1] but I did not encounter it.

Segmentina armigera (Say).

Physa heterostropha (Say). Found in Bacon's Brook and in the lake in late summer, 1909.

Physa ancillaria Say. Not encountered until April, 1910, when it was abundant along the shore of the lake, apparently displacing the preceding species.

Aplexa hypnorum (Linn.). Common in pools on the Intervale.

Carychium exiguum (Say). Windermere. Common, Sept., 1909.

Cochlicopa lubrica (Müll.). Common around wood piles, 1905, 1909.

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[1] Mighels: *P. trivolvis* [+ *P. lentus*?], Bost. Jour. Nat. Hist., 1843, p. 335.

Vallonia pulchella (Müll.). Common with preceding, 1905. Rarer in 1909.

Acanthinula harpa (Say). Windermere. One specimen, Sept., 1909.

Strobilops virgo (Pils.). Windermere. Common Sept., 1909; also in woods W. of the village (Apr., 1910). All of the red variety [Clapp].

Bifidaria pentodon (Say). Windermere. Four specimens, Sept., 1909.

Vertigo ovata Say. One adult specimen in village, 1905; several juv. probably of this species at Windermere, Sept., 1909.

Vertigo gouldii (Binney). One nearly grown and several young probably the same, Windermere, Sept., 1909.

Succinea ovalis Say, (obliqua Say). Abundant.

Succinea avara Say. The Intervale. Four specimens, 1909-'10.

Pyramidula alternata (Say). Common in scattered localities.

Pyramidula cronkhitei anthonyi (Pils.). Abundant.

Helicodiscus parallelus (Say). Windermere, Sept., 1909, and woods W. of village, Apr., 1910. Rare.

Punctum pygmaeum (Drap.). Windermere.

Agriolimax campestris (Binn.). Common in the village.

Vitrina limpida Gld. Abundant about wood piles in 1905, but not seen in 1909.

Vitrea sp. Windermere, 1909. All young.

Euconulus fulvus (Müll.). Windermere, Sept., 1909.

Euconulus chersinus (Say), (polygyratus Pils.). With the preceding and about twice as abundant.

Zonitoides arboreus (Say). Abundant.

Zonitoides exiguus (Stimp). Windermere, 1909. Common.

Zonitoides milium (Morse). Windermere, Sept., 1909.

Polygyra albolabris (Say). Does not appear to be abundant, but is widely distributed.

Polygyra fraterna (Say). Several specimens in 1909.

Summary:

	Species.	Vars.
Fresh-water lamellibranchs . . .	6	+ Pisidium spp.
Fresh-water gastropods	16	2
Terrestrial gastropods	24	
Total	46 +	2 +

SOME NOTES ON THE OLIVIDAE.

BY CHARLES W. JOHNSON.

II.

OLIVA VIDUA (Bolten).

Porphyria vidua Bolten, Mus. Boltenianum, p. 34, 1798.

Oliva maura Lam., Ann. du Mus., XVI, p. 309, 1810.

As in the case of *O. sericea*, both Bolten and Lamarck again refer to the same figures by Martini (Conch. Cab., II, tab. 45, figs. 472, 473). The variation of the species is well shown by Marrat under the name "*mauritiana*" Martini (Sowerby's Thes. Conch., IV, pl. 10, figs. 133–140). The figures referred to by Bolten represent one of the extreme variations. What would probably be considered the normal color is represented by the var. *sepulturalis* Lam. (Marrat, fig. 133). This variety in losing entirely the brown markings becomes the olive-green or yellowish *fenestrata* Bolten, or with the dark brown assuming wide, irregular, longitudinal stripes, the var. *fulminans* Lam., while these stripes suffusing form the dark brownish-black *vidua*. On the other hand there is a tendency for the shells to become gradually lighter in color than *sepulturalis*, such forms representing the var. *macleaya* Duclos (Marrat, fig. 140).

It is this latter variety that leads to what is probably one of the most puzzling groups of shells to define specifically that exists. One cannot realize this difficulty from a few shells which usually fall quite readily into one of the numerous species. With over 200 specimens of the group comprising *vidua*, *tigrina* and *elegans* there are some specimens so intermediate in character as to make it very difficult to draw the line. To unite these, however, upon the character of the shells alone, with the meagre data bearing upon their distribution and the environmental conditions governing variation, would in no way add to our knowledge of the group or aid in its future study. It seems to be the diverging point of a number of species or groups of species, the true relationship of which is at present hard to define.

OLIVA TIGRINA Lamarck.

O. tigrina Lam., Ann. du Mus., XVI, p. 322, 1810 (*non* Meuschen).

? *O. glandiformis* Lam., Ann. du Mus., XVI, p. 317, 1810.

This species is distinguished from *vidua* var. *macleaya* in being less cylindrical in outline with the sutural callus less elevated. The

normal form has maculations or bands of dark brown which often become suffused and cover the entire shell, this extreme variation (var. *fallax* n. var.) masquerading in many collections under the name of *maura*. The usual form of *tigrina* is without the brown bands or maculations, only the small bluish-gray spots showing. In large senile specimens the spots often become obsolete or wanting on the last third of the body whorl. The dark forms figured by Marrat as *glandiformis* (fig. 174), approach closely (as in the case of *elegans*) forms of *funebralis* Lam. The *glandiformis* Lam., if recognizable, would take precedence over *tigrina*, but the figure referred to by Lamarck in Adanson's Hist. Nat. Senegal, pl. 4, fig. 6, is not identifiable.

Oliva bulbosa (Bolten).

Porphyria bulbosa Bolten, Mus. Boltenianum, p. 34, 1798.

Oliva undata Lam., Ann. du Mus., XVI, p. 318, 1810.

Oliva inflata Lam., *l. c.*, XVI, p. 319, 1810.

This variable species is always readily distinguished by having a heavy callus ridge on the fasciole, independent of the columellar plaits. In other respects many specimens closely resemble the more inflated examples of *tigrina*.

Both Bolten and Lamarck refer to the same figure by Martini (Conch. Cab., II, Tab. 47, figs. 507, 508), which represents specimens having undulating longitudinal stripes of brown. Specimens with only the small uniform bluish-gray spots constitute the var. *inflata* Lam.; when two revolving dark brown bands are present the var. *bicingulata* Lam.; when the bands fuse and cover irregularly the greater portion of the shell they represent the var. *fabagina* Lam. The latter is figured by Marrat as "crassa" Martini. Pure white examples are also frequently observed.

Oliva elegans Lamarck.

O. elegans Lam., Ann. du Mus., XVI, p. 312, 1810.

O. flava Marrat, Sowerby's Thes. Conch., IV, pl. 11, figs. 156, 157.

O. infranata Marrat, *l. c.*, pl. 12, fig. 161.

This species, though smaller, has the more cylindrical form and elevated sutural callus of *vidua*. Light-colored examples with bright salmon-colored fasciole resemble in a general way *variegata* Bolten. It also has a similar range in color to the latter species, and lacks the

dark fulvous and melanic forms of *vidua*. Small, dark forms, on the other hand, are often very close to specimens referable to *funebralis* Lam. *O. tricolor* Lam. seems to be a good species, and not a variety of *elegans*.

Oliva funebralis Lamarck.

This species seem to occupy an intermediate position between *tigrina* and *elegans*. It is beautifully illustrated by Marrat (Thes. Conch., pl. 11, figs. 143–148) under the names of "*leucostoma*" Ducl. and "*labradorensis*" Bolten. The figure cited by Bolten in Lister, tab. 731, fig. 20, is unrecognizable, so that *labradorensis* can fortunately be dropped. The narrower form suggests a probable relationship to the narrow, cylindrical *mustelina* Lam., while the broader form shows a tendency towards the more inflated *dactyliola* Ducl.

Oliva dactyliola Duclos.

This seems to hold an intermediate position between *funebralis* and *bulbiformis*, having the spire of the former and outline of the latter.

Oliva bulbiformis Duclos.

This species is distinguished from the preceding in having a much smaller spire usually entirely covered by a callus. *Oliva similis* Marr., is evidently a variety without the callus spire. This species seems to naturally lead to the small callus-spired species, such as *mucronata* Marr., *lepida* Ducl., *todosina* Ducl., *carneola* Gmel., *tessellata* Lam., etc.

Oliva carneola Gmelin.

There are entirely or partially mottled specimens of this species which seem to connect *lepida* and *todosina* with this species.

Oliva mustelina Duclos.

The deep suture and cylindrical form, often noticeably narrower towards the anterior, suggest an approach to *scripta*. Specimens with interrupted revolving bands constitute the var. *angustata* Marr. *O. athenia* Ducl., resembles this species in miniature.

Oliva scripta Lamarck.

The suture is deep and wide. The color markings resemble *O. litterata* Lam.

OLIVA VARIEGATA (Bolten).

Porphyria variegata Bolten, Mus. Boltenianum, sp. 393, p. 33, 1798.

Porphyria reticulata Bolten, Mus. Boltenianum, sp. 396, p. 33, 1798.

Oliva sanguinolenta Lam., Ann. du Mus., XVI, p. 316, 1810.

Oliva evania Duclos, Monogr., in Comp. Rendus, II, tab. 20, figs. 3, 4, 1836.

This species varies from the grayish-white reticulated form first referred to by Bolten, to the dark, finely reticulated olive-green var. *reticulata*. In the latter case both Bolten and Lamarck refer to the same figures by Martini (Conch. Cab., II, tab. 48, figs. 512, 513). The fasciole is always a bright orange red, the spire finely marked with brown, and the two revolving bands usually quite distinct. A number of specimens from Negros Island, Philippines, collected by Mr. E. L. Moseley, are all the var. *reticulata*, and show but little variation. Marrat is undoubtedly wrong in uniting Bolten's *variegata* with Lamarck's *tricolor*. *O. evania* is only a very light-colored example.

OLIVA TRICOLOR Lamarck.

This species has the outline of *variegata* and not of *elegans;* it has the salmon-colored fasciole, but the color of the shell is very different from either. The dark specimens are bluish-green, with bands of a slightly darker shade—not brown; the entire shell is spotted with yellow, spire and lip coarsely marked with brown. Light-colored specimens often have bright yellow and blue spots; with the bands obsolete or wanting, such specimens often resemble *caerulea* so closely as to be only separated by the violet-colored aperture of the latter.

OLIVA CAERULEA (Bolten).

Porphyria caerulea Bolten, Mus. Boltenianum, p. 33, 1798.

Oliva episcopalis Lamarck, Ann. du Mus., XVI, p. 313, 1810.

Although the two authors refer to different figures there seems to be no doubt as to their identity. Bolten refers to a very good figure by Martini (Conch. Cab., II, tab. 48, fig. 518), while Lamarck cites an uncolored though recognizable figure by Lister (tab. 719, fig. 3), with a description of the species. The revolving bands which are obsolete or wanting in the adult shell, are quite prominent in younger specimens which closely resemble some variations of *ispidula*.

Young specimens are also before me in which the violet color of the aperture is wanting.

Oliva amethystina (Bolten).

Porphyria amethystina Bolten, Mus. Bolt., p. 35, 1798.

Voluta cruenta (Solander) Dillw. Call, I, p. 514, 1817.

Oliva guttata Lam., Ann. du Mus., XVI, p. 313, 1810.

Both Bolten and Lamarck refer to the same figures by Martini (Conch. Cab., II, tab. 46, figs. 491, 492). The variation of the species is well shown by Marrat under *emicator* Meuschen (Thes. Conch., pl. 5, figs. 57–60). This species may vary from spotless to the typical form with large regular spots, or to that with large splotches and fine flecks. Many specimens show a peculiar malformation consisting of an elevated ridge at the periphery. Additional synonyms by Marrat are *aurata* Link and *mantichora* Duclos.

Oliva ispidula Linné.

As stated under *cærulea* varieties of this species closely resemble the younger and smaller examples of that species. The species is extremely variable, more so, perhaps, than any other, notwithstanding it is as a rule readily recognized by its brown aperture. Specimens from Samar, Philippines, collected by Mr. E. L. Mosely, are all uniform in color, representing the dark reticulated form (Marrat, Thes. Conch., fig. 248), The var. *flaveola* Duclos is yellow with a white aperture; its relation to *ispidula* is apparent from the fact that specimens frequently show a trace of the broad dark subsutural band common to many of the typical examples. This species seems to lead to the small high-spired species, including *O. flamulata* Lam., *duclosi* Reeve (*jaspidea* Ducl., *non* Gmel.), *rufopicta* Wienk., *kaleontina* Ducl., *australis* Ducl., *panniculata* Ducl., etc., some of which resemble species of Olivella.

MOLLUSKS OF UNIONVILLE, CONN.

BY FRANK C. BAKER.

In June, 1909, several days were spent in the village of Unionville, and much of the time was enjoyably occupied in hunting for the lowly mollusks. As local lists from Connecticut are rare, it has been thought that a catalogue of the species obtained might be of value for the purpose of geographic distribution. Unionville is about nine miles west of Hartford.

PELECYPODA.

Anodontoides ferussacianus subcylindraceus (Lea). Roaring Brook.

Anodonta marginata Say. Farmington River, above dam.

Alasmidonta undulata (Say). Mill race, near dam; Roaring Brook.

Unio complanatus (Sol.). Mill race, near dam; Roaring Brook; Pond's Brook.

Margaritana margaritifera (Linné). Pond's Brook.

Pisidium subrotundum Sterki. Small pools in swamp; Cherry Pond Creek.

GASTROPODA.

Campeloma decisum (Say). Roaring Brook; Farmington River, above dam.

Physa sayii Tappan. Overflow from mill race; Cherry Pond; small stream flowing into Farmington River above dam.

Planorbis bicarinatus Say. Cherry Pond; small streams above dam, Farmington River.

Segmentina armigera (Say). Cherry Pond; drainage ditch east of Cherry Pond Creek (on bottom in grass).

Lymnaea columella (Say). Cherry Pond.

Strobilops labyrinthica (Say). Top of hills, east of Farmington River.

Succinea ovalis Say. Lewis' Woods.

Succinea avara Say. Lewis' Woods.

Philomycus carolinensis (Bosc.). Cherry Park, under log.

Helicodiscus parallelus (Say). Top of hills, east of Farmington River.

Zonitoides arborea (Say). Woods east of Roaring Brook; Cherry Park; top of hills east of Farmington River.

Zonitoides nitida (Müller). Near Curtis' Pond.

Euconulus fulvus (Müller). Top of hills, east of Farmington River.

Vitrea indentata (Say). Top of hills, east of Farmington River.

Vitrea hammonis (Ström.). Woods east of Roaring Brook; Cherry Park.

Polygyra hirsuta (Say). Top of hills, east of Farmington River; woods east of Roaring Brook.

Polygyra fraterna (Say). Lewis' Woods.

Polygyra albolabris (Say). Woods east of Farmington River.

PUBLICATIONS.

Mollusca of the Southwestern States. III: The Huachuca Mountains, Arizona. IV: The Chiricahua Mountains, Arizona.—By H. A. Pilsbry and J. H. Ferriss. (Proc. Acad. Nat. Sci., Phila., Nov., 1909, and Feb., 1910.) In a notice of an earlier number of this series I recalled the way in which the malacological riches of the arid southwest were first brought prominently to light, and the astonishment they created. Nowadays we have become so accustomed to hearing of new things from that region, that we no longer get excited over additions to *Ashmunella*, *Sonorella* or *Oreohelix*. If the first flush of discovery has thus departed, and in a certain sense the continuation of the work is almost monotonous, it must be remembered that we are approaching a second stage, in which the abundance of the data will permit generalization not to be thought of before. Thus the important scientific results lie in front and not behind, and it is only through minutely careful survey work, like that of Messrs. Pilsbry and Ferriss, that they will ever be realized. Already these authors feel justified in making the following interesting statement:

"The facts developed in our Arizona work lead us to doubt the potency of environment as a direct agent in effecting specific differentiation, or at least to assign to such factors a wholly subsidiary role. The facts seem explicable only on the hypothesis of variations existing or arising in the constitution of the egg, leading to modifications of the adult organism which for the greater part are indifferent as affecting the well-being of the race. Such adaptation as exists would apparently be due to selection. The isolation of small colonies in these mountains must favor the survival of what are currently called mutations occurring therein. The occasional mingling of neighboring colonies in which diverse variations have arisen seems to have led to such heterogeneous colonies as we have described in *Holospira*."

In a footnote is added:

"We believe this to be the explanation of the diversity of colonies in the polychromatic arboreal snails such as *Partula* and *Liguus*, in which some colonies of a given species are homogeneous, while others are heterogeneous, snails of several definite color-patterns being the offspring of a single mother."

In this connection it is interesting to compare Prof. W. L. Tower's results with Mexican beetles of the genus *Leptinotarsa*, recently pub-

lished in *Biological Bulletin*, May, 1910. Tower found two closely allied beetles occupying different sides of the Mexican table-land, and was able to cross them, getting various combinations in the offspring, an interesting feature being that the larval characters were inherited separately, so that in one experiment four different kinds of larvæ *each* gave the same three kinds of adults. The account of the experiments is not altogether clear and consistent, but it is evident that among these beetles related forms may cross quite freely, and produce fertile progeny presenting new combinations of the parental characters. As Messrs. Pilsbry and Ferriss have indicated, it is not unlikely that similar phenomena occur among snails, and no doubt there is a rich field open to the experimental breeder.

The two papers before us give an account of the snails of the Huachuca and Chiricahua mountains. The first Huachuca snails to be collected were species of *Ashmunella* (*A. varicifera* and *levettei*), obtained by Messrs. Cox and Levette, and reported as from "Tucson" and "near Santa Fé, New Mexico," respectively. It is now definitely ascertained that they are confined to the Huachucas. The authors state that they know nothing of Cox beyond his name upon the label, but he was doubtless the Cox who was known to entomologists as a collector of cynipid galls, one of the gall-flies being named after him by Bassett. The first Chiricahua mollusc was obtained by Vernon Bailey, and was described by Stearns in 1890 as *Holospira arizonensis*. The richness and individuality of the snail-faunæ of these ranges is well brought out by the following table, which includes species only:

	Huachucas only.	Both ranges.	Chiricahuas only.
Sonorella	4	0	6
Ashmunella	4	0	9
Oreohelix	1	0	3
Pyramidula	1	1	0
Helicodiscus	0	1	0
Radiodiscus	0	1	0
Punctum	0	0	1
Thysanophora	0	1	1
Holospira	1	0	3
Agriolimax	0	1	0
Vitrina	0	1	0
Zonitoides	0	3	0

Vitrea . . .	0	1	0
Euconulus . .	0	1	0
Succinea . .	0	1	0
Vallonia . .	1	1	0
Pupilla . . .	0	1	0
Bifidaria . .	1	4	4
Vertigo . . .	2	2	2
Cochlicopa . .	0	1	0
	15	21	29

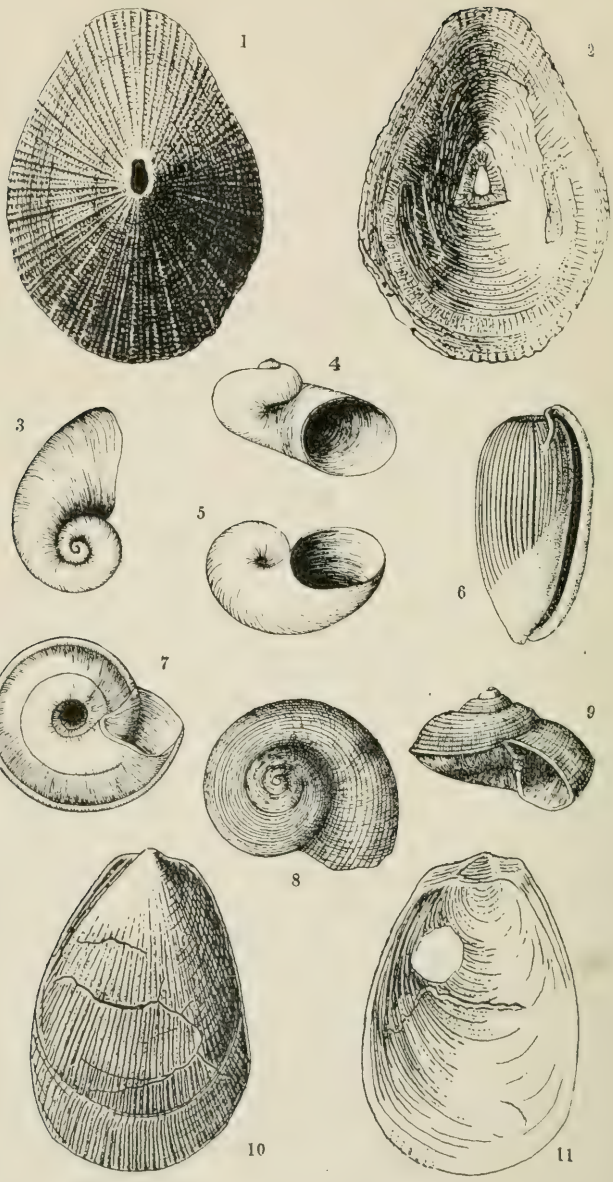
There are in addition numerous local races or subspecies of the *Helicidæ*. All the larger snails of the Chiricahuas, 21 species with 14 subspecies, are wholly confined to that range. The small snails, on the other hand, are widely distributed.

It will be seen from the above that Messrs. Pilsbry and Ferriss have not only made very important additions to the snail fauna of the United States, but have contributed most valuable data toward the elucidation of those problems of heredity and evolution which are puzzling us all. May they have the time and strength for many other such contributions. T. D. A. Cockerell.

NOTES.

Shells of Mt. Equinox, Vermont.—The following species were obtained by the writer on the eastern side of Mt. Equinox, near Manchester, Vt., in June, 1910, on one of the collecting trips of the Boston Society of Natural History, in company with Messrs. G. M. Allen and J. A. Cushman: *Polygyra albolabris* Say, *P. sayana* Pils., *P. tridentata* Say, *P. fraterna* Say, *Circinaria concava* Say, *Pyramidula alternata* Say, *P. cronkhitei anthonyi* Pils., *Omphalina fuliginosa* Griff., *Zonitoides arborea* Say and *Succinea ovalis* Say. In a small lake at the foot of the mountain *Lymnæa desidiosa* Say, *Planorbis bicarinatus* Say and *Physa heterostropha* Say were also obtained.—C. W. Johnson.

W. F. Petterd.—In Hobart, Tasmania, on April 15, 1910, occurred the death of Mr. W. F. Petterd, a veteran conchologist. He wrote considerable on the land shells of his native island. Mineralogy was another study to which he had made valuable contributions. He had traveled extensively in Australia and the Pacific islands.—C. Hedley.



ALDRICH: NEW EOCENE FOSSILS.

The Nautilus.

Vol. XXIV. NOVEMBER, 1910. No. 7

NEW EOCENE FOSSILS FROM THE SOUTHERN STATES.

BY T. H. ALDRICH.

[Plate IV, fig. 6, Ovulactæon aldrichi Wheeler, described in the June No., p. 13.—Ed.]

Fissuridea maauryi n. sp. Pl. IV, figs. 1, 2.

Shell large, of medium height, narrowed at the anterior, and bent slightly downward; regularly oval on the posterior. Foramen rather large, somewhat keyhole-shaped; shell radiately sculptured, with about 32 strong primary ribs, generally with two smaller ribs between, at the anterior the ribs are nearly equal and closely set, the crossbar to the foramen deeply pitted, and the foramen itself triangular within.

The close-set lines of growth are very numerous; they break up the ribs into low nodules. Margin of shell strongly crenulate and flattened within. Longest diam. 31 mm.; breadth 24 mm.; height 11 mm.

Locality. Matthews Landing bed on Dale Branch, near Oak Hill, Ala. Named in honor of Miss Carlotta J. Maury, a co-worker in Tertiary palæontology. Figures by Prof. G. D. Harris.

Adeorbis? nautiloides n. sp. Pl. IV, figs. 3, 4 and 5.

Shell very small, substance rather thin; whorls three, expanding rapidly. The body whorl separating and extending beyond the other whorls; surface smooth except near the aperture where a few growth lines become coarser; umbilicus small. The figure does not show the separation of the whorls well.

Longest diam. about 2 mm.

Locality. De Soto, Miss. Claibornian.

Remarks. This singular little species is doubtfully placed in *Adeorbis*. It might just as well be put in *Valvata*. It is hardly an embryonic shell, but in any event it is an interesting development wherever it really belongs.

ADEORBIS SOTOENSIS n. sp. Pl. IV, figs. 7, 8, 9.

Shell small, whorls five; spire pointed, smooth; whorls covered with spiral lines which are nearly obsolete just below the suture, growing more prominent on the body whorl as they approach the periphery. The effect is to make a broad, nearly smooth band on the whorls to the eye; under a glass this space shows exceedingly fine spirals. Body whorl strongly keeled, base smooth, umbilicus moderate. Aperture ovate. Diameter a little less than 2 mm.

Locality. De Soto, Miss., just above the *Ostrea sellæformis* bed. Claibornian.

LIMA HARRISIANA n. sp. Pl. IV, figs. 10, 11.

Shell oblong, slightly oblique, radially sculptured, covered with close-set lines slightly nodular; between them in the sunken spaces are fine dotted lines which die out towards the hinge line and umbo. The ribs are very numerous, near the umbo on one side they appear quite nodulous; ears very unequal, hinge nearly straight, but somewhat inclined to the central axis. In a young specimen the outer ribs appear to be nodulous and the inner margin denticulated.

Longest axis 17 mm.

Locality. Smithville, Texas. Claibornian.

Remarks. This species seems to be rather close to *L. vicksburgiana* Dall, but has many more ribs, over 50 in all.

Named in honor of Prof. G. D. Harris, who has kindly furnished the illustrations.

ERRATA.

In Bulletin of American Paleontology, No. 8, 1897, p. 10, Pl. II, fig. 5, I described a small shell as *Actaeon cossmanni*. This should have been written *Acteonina* (*Crenilabium*) *cossmanni*, nobis. A mistake was made in transcribing. It was however manifest as the writer placed it in the proper subgenus.

EULIMA COSSMANNI n. sp.

M. Cossmann has figured in "Notes Complementaires," Pl. I, fig. 34, page 27, 1893, as *Rissoina notata* Lea, a form that is not the species of Lea but a new form of *Eulima*, which may be called *E. cossmanni*. The shell described by Lea is also a *Eulima*.

The description and figure given by M. Cossmann are accurate for this new species. The true species of Lea also has a sinuous outer lip.

Dr. Paul Bartsch has examined specimens of the true *Pasithea elegans* H. C. Lea, and finds it to be a *Bittium*.

NOTES ON TRUNCILLA, WITH A KEY TO THE SPECIES.

BY BRYANT WALKER.

As the highest expression of Unione development, the *Truncillæ* are of special interest to the systematic conchologist. Not only are the sexes sharply differentiated in all the species, but the species themselves are more clearly defined and less subject to variation than in any other of the recognized genera.

For this reason, the species are well adapted to the rigid limitations of a key, which in the more variable groups would, in many cases, be almost impracticable. But in genera such as this, where the specific lines can be drawn with sufficient exactness for such a purpose, the formation of a key, besides facilitating the identification of the species, is of great service in developing the peculiar distinguishing characters of the different species, and thus determining their proper position in a natural arrangement.

In attempting to make a key to the species of *Truncilla*, it almost immediately became obvious that, owing to the extreme differentiation of the sexes, which very often was not along analogous lines in species of the same group, a single key including both sexes was not feasible, and accordingly a separate key for each sex was made.

This condition also demonstrated that a consistent natural arrangement of the species would have to be based primarily on the variations of one of the sexes.

In view of the fact that the most recent classification of the *Unionidæ* is based primarily on the modifications of the gill of the

female incident to reproduction, and that *Truncilla* is the genus in which the sexual differentiation of the female has been carried out to the greatest extent, it would seem desirable that a systematic arrangement of the species in the genus should be, as far as possible, based on that feature.

At the present time such an arrangement must necessarily be based almost wholly on shell characters, and these are mainly to be found in the position of the so-called marsupial expansion. The indications afforded by these characters should, of course, be supplemented by an exhaustive study of the gill itself and its modifications for the purpose of a marsupium, and, until that is done, it is scarcely advisable to attempt to define the subordinate groups in any formal manner or to change the present classification.

In respect to their peculiar shell characters, the female *Truncillæ* fall naturally into three groups:

1. Those in which the entire post-basal area is occupied by the marsupial expansion.

This group is more closely allied in this respect to *Lampsilis* than any of the others, and is apparently the more primitive form. *T. perplexa* is the leading exponent of this group.

2. Those in which the marsupial expansion is restricted substantially to an inflation and modification of the posterior ridge.

This might be considered the next stage of development, and is typified by *T. triquetra.*

3. Those in which the marsupial expansion is anterior to the posterior ridge and more or less distinctly separated from it.

The extreme form of this group is the well-known *T. foliata*, which may well be considered the most highly organized species of the genus. Between it and *T. hayesiana*, in which the expansion, though anterior to the posterior ridge, is scarcely differentiated from it, and which may, therefore, be considered the other extreme of the series, there is a very considerable amount of variation in this particular. An intermediate stage is that represented by *T. sulcata* and *lenior*, in which the expansion, though distinct, is separated from the posterior ridge by a narrow but deep sulcus, which forms a distinct notch at the margin, instead of the wide emargination that is present in *foliata* and its immediate allies.

Arranged in this way the species show a distinct line of evolution, from the simple to the complex, caused by the progressive differ-

entiation of the marsupial expansion and its advance from a position at the extreme posterior part of the shell to a median one almost directly under the beaks.

An arrangement of the species in this manner would result as follows:

1. Marsupial expansion occupying the entire post-basal area:

T. perplexa, *T. biemarginata*,
T. perplexa rangiana, *T. capsæformis*,
T. sampsoni, *T. florentina*,
T. propinqua, *T. deviata*.

2. Marsupial expansion formed by an inflation of the posterior ridge:

A. Not extending below the basal line:

T. triquetra, *T. arcaeformis*.

B. Extending below the basal line:

T. penita, *T. compacta*, *T. metastriata*.

3. Marsupial expansion in front of the posterior ridge and more or less separated from it:

A. Scarcely differentiated from the posterior ridge:

T. hayesiana, *T. modicella*, *T. othcaloogaensis*.

B. Separated from the posterior ridge by a narrow sulcus, notching the post-basal margin:

T. brevidens, *T. sulcata*, *T. lenior*.

C. Separated from the posterior ridge by a wide emargination:

T. personata, *T. lewisii*,
T. stewardsonii, *T. foliata*.

It is to be noted that while *brevidens* from the position of the expansion falls in this group, in other characters it is more closely related to *penita* and *compacta* and thus forms a connecting link between the two groups. It might, perhaps, be considered an example of development along similar lines arising from a different ancestral stock. It also illustrates the futility of attempting to draw arbitrary lines in any system of classification. Nature does not do things in that way.

In this arrangement, the synonymy as established by Simpson is followed, with the exception that *T. compacta* Lea is recognized as distinct from *penita* Con. Mr. Simpson informs me that, from the examination of additional material since the publication of the Synopsis, he has come to the same conclusion.

T. metastriata is doubtfully distinct from *compacta* and is probably, at the most, only a local form peculiar to the Black Warrior river. If this is correct, it has priority over *compacta*.

The male of *T. othcaloogaensis* is unknown.

Key to the Species of Truncilla.

A. *Males.*

1. Shell with a distinct radial furrow in front of the posterior ridge . . . . . 2.
   Shell without a distinct radial furrow in front of the posterior ridge . . . . . 12.
2. Shell subquadrate or subtriangular; radial furrow subvertical . . . . . 3.
   Shell suboval; radial furrow oblique . . . . . 8.
3. Shell subcompressed, subquadrate or broadly subtriangular; umbonal region flattened, beaks depressed . . . . . 4.
   Shell subtriangular; beaks elevated, umbonal region inflated . . . . . 7.
4. Posterior ridge strongly biangulate . . . . . *biemarginata.*
   Posterior ridge rounded . . . . . 5.
5. Central ridge well developed, forming an obtuse angle in the basal line at its extremity, between which and the posterior ridge the base line is nearly straight, radial furrow wide and conspicuous . . . . . 6.
   Central ridge less developed, not projecting beyond the basal outline, which is scarcely emarginate in front of the posterior ridge, radial furrow subobsolete . . . *stewardsonii.*
6. Shell subquadrate, solid, central ridge subnodulous, radial furrow deep . . . . . *foliata.*
   Shell smaller, subsolid, central ridge smoother, radial furrow less impressed . . . . . *lewisii.*
7. Posterior slope smooth, nacre white . . . . . *personata.*
   Posterior slope radially striate, nacre usually purple. *hayesiana.*
8. Posterior slope convex, posterior end below the middle . . 9.
   Posterior slope nearly straight, posterior end at or above the middle . . . . . 10.
9. Central ridge nodulous . . . . . *perplexa.*
   Central ridge smooth . . . . . *propinqua.*
10. Post-basal margin emarginate . . . . . 11.
    Post-basal margin squarely subtruncate . . . . . *sulcata.*
11. Shell short oval, post-basal emargination deep, umbonal region greatly inflated . . . . . *sampsoni.*
    Shell more elongate, post-basal emargination shallow, umbonal region less inflated . . . . . *perplexa rangiana.*
    Shell smaller, posterior ridge biangulate, basal emargination shallow, beaks prominent . . . . . *deviata.*

12. { Posterior ridge rounded . . . . . 13.
{ Posterior ridge more or less distinctly biangulate . . . . 19.

13. { Posterior slope distinctly flattened . . . . . 14.
{ Posterior slope not flattened . . . . . 18.

14. { Umbonal region flattened . . . . . 15.
{ Umbonal region inflated . . . . . 16.

15. { Shell subquadrate, subcompressed . . . . . *brevidens.*
{ Shell smaller, oval, less compressed, beaks more anterior. *metastriata.*

16. { Shell distinctly triangular, anterior margin not projecting much beyond the anterior umbonal slope, unicolored or with capillary green rays . . . . . 17.
{ Shell triangularly ovate, anterior margin projecting beyond the umbonal slope, conspicuously painted with green rays and blotches . . . . . *triquetra.*

17. { Beaks flattened, subcentral . . . . . *penita.*
{ Beaks higher, more anterior, shell smaller . . . . *compacta.*

18. { Shell small, subtriangular, thick and solid . . . . *modicella.*
{ Shell larger, oval and thin . . . . . *lenior.*

19. { Shell large, greatly inflated, thick, solid, posterior ridge very prominent, posterior slope with a well-defined furrow, surface rough, rays capillary . . . . . *arcæformis.*
{ Shell smaller, less inflated, posterior ridge less developed, surface smooth, broadly rayed with green . . . . . 20.

20. { Shell subcompressed, elliptical . . . . . *capsæformis.*
{ Shell smaller, short oval, quite inflated . . . . . *florentina.*

B. *Females.*

1. { Marsupial expansion swollen . . . . . 2.
{ Marsupial expansion flattened . . . . . 13.

2. { Marsupial expansion an inflation of the posterior ridge . . 3.
{ Marsupial expansion in front of and distinctly separated from the posterior ridge . . . . . 9.

3. { Posterior ridge angularly inflated and curved backwards . 4.
{ Posterior ridge roundly inflated and curved forwards . . 5.

4. { Posterior ridge sharp, dorsal slope obliquely truncate, flattened, base of expansion rounded . . . . . *triquetra.*
{ Posterior ridge less angular, dorsal slope not flattened, biangular, base of expansion flattened . . . . . *arcæformis.*

5. { Base of expansion distinctly projecting beyond the basal line . . . . . 6.
{ Base of expansion scarcely projecting beyond the basal line . . . . . 8.

6. Posterior ridge inflated, basal expansion rounded, its margin rounded . . . . . 7.
Posterior ridge not inflated, basal expansion flattened, its margin subquadrate . . . . . *penita.*

7. Shell large, subquadrate, disk distinctly flattened, with numerous, fine, capillary rays . . . . . *brevidens.*
Shell smaller, subtriangular, posterior ridge inflated, rayless. *compacta.*
Shell still smaller, beaks less elevated, greatly inflated posteriorly, rayless . . . . . *metastriata.*
Shell very small, subquadrate, marsupial expansion narrow and not much inflated . . . . . *modicella.*

8. Posterior slope radially striate, a median furrow in front of the marsupial expansion, nacre usually purple . *hayesiana.*
Posterior slope scarcely striate, no median furrow, nacre white . . . . . *othcaloogaensis.*

9. Marsupial expansion a prolongation of the median ridge, separated from the posterior ridge by a wide emargination . . . . . 10.
Marsupial expansion occupying and nearly filling the radial furrow, not projecting beyond the basal line . . *personata.*
Marsupial expansion at posterior base and separated from the posterior ridge by a deep sulcus, notching the margin . 12.

10. Marsupial expansion rounded . . . . . 11.
Marsupial expansion triangular . . . . . *lewisii.*

11. Shell large, center of disk inflated, marsupial expansion separated from posterior ridge by a deep median furrow. *foliata.*
Shell much smaller, center of disk compressed, no median furrow . . . . . *stewardsonii.*

12. Shell quadrate, rather solid, marsupial expansion extending beyond the posterior ridge . . . . . *sulcata.*
Shell smaller, oblong, thin, marsupial expansion not extending beyond the posterior ridge . . . . . *lenior.*

13. Entire post-basal region flatly and broadly expanded, marsupial extension thin, shining, and of different texture from the rest of the shell . . . . . 14.
Expansion of the post-basal region less extensive, less compressed, and of the same color and texture as the rest of the shell . . . . . 15.

14. Shell with a distinct radial furrow and nodulous median ridge . . . . . *perplexa.*
Shell smaller, smooth, and without a distinct radial furrow. *capsæformis.*

15. Shell with a distinct radial furrow extending to the beaks.16.
Shell without a distinct radial furrow . . . . . 17.

16. Shell oval, umbonal region inflated, beaks prominent, posterior ridge rounded . . . . . *propinqua.*
Shell subquadrate, umbonal region compressed, beaks flattened, posterior ridge biangulate . . . . . *biemarginata.*

17. Shell larger, solid, margin of marsupial expansion simple. 18.
Shell much smaller, thinner, margin of marsupial expansion dentate . . . . . .19.

18. Shell subquadrate, marsupial expansion small, posterior margin subtruncate, umbonal region greatly inflated. *sampsoni.*
Shell oval, marsupial expansion larger, posterior margin regularly rounded, umbonal region less inflated . *rangiana.*

19. Shell obovate, marsupial expansion extending below the base line, beaks depressed, dorsal slope rounded . *florentina.*
Shell subtriangular, marsupial expansion not extending below the base line, beaks prominent, dorsal margin elevated . . . . . *deviata.*

SHELLS FROM THE BAY OF CADIZ REGION.

BY MAXWELL SMITH.

While on a recent visit to Spain I arranged to spend three days on the shores of the Bay of Cadiz in hopes of contributing toward the knowledge of its molluscan fauna. With the limited time at my disposal only a superficial inspection of the beaches could be made, but the results were so satisfactory, although yielding only a comparatively small series of species, that I felt that I was indeed amply repaid.

By comparing the list which follows this article it will be seen that the material brought together is a curious mixture of Mediterranean, African and Atlantic shells. Just what lives in the bay, and what not, can only be determined by careful dredgings.

Through the kindness of Mrs. Whishaw, of Seville, her summer home, an old palace dating from the 16th century, was placed at our disposal. This was located on the shore of the Bay of Cadiz at the town of Port Saint Mary, or Puerto de la Santa Maria as it is called in Spanish.

It was on April 30 of this year that we left the heat of Seville and rode by train through this rich wine-growing section of the country down to the bay. Port Saint Mary was found to be a typical Spanish

town, with its one long, wide street lined with whitewashed houses and palaces of better days. It is a sleepy town all day, when the sun shines week in and week out, but at sunset there is a change. The inhabitants throng the streets, and the men loading the steamers along the river side with sherry work harder than ever. Most of this goes to America, and comes from near Jerez, upstream. It is brought down by river or railway from the country and transferred to an ocean-going freighter at Port Saint Mary. This seems to be the only industry of the place besides fishing. At this season of the year few shell fish were offered for sale at the market.

Port Saint Mary was far from a dull place to me, as it might have proved to some persons. Every moment was occupied in searching the beaches, the tide flats and the infrequent bits of rock.

It was the day after I arrived that I made an excellent "find." A long search had been made for minute species with little success when I came across the following: A small cup-shaped depression was observed in the sand, over which ran several streamlets. This was filled with thousands, perhaps tens of thousands, of minute shells all in perfect preservation. As the tide was rapidly coming in the only thing to do was to gather together as much of the material as was possible and bring along. This was done, and it required many hours of following days to work the lot out.

Upon my return to Seville a few days later Mrs. Whishaw kindly gave me a number of species which she had obtained herself on the beaches. Those of the lot, which I had not taken myself, I have incorporated in the appended list.

Several walks were made to distant portions of the shore line. These have been noted in the list, giving the name of the nearest town.

To Mrs. Whishaw I owe many thanks for help and suggestions, besides a series of local material from the bay taking during the last few summers. In preparing the following catalogue I am especially indebted also to Monsieurs Lamy and Germain, of the Malacological Laboratory, of Paris, for assistance in determinations.

Cephalopoda.

Sepia officinalis L. A few.

Spirula pronii Lam. Mrs. Whishaw, several shells.

GASTROPODA.

Helix apicina Lk. On the ground.

Helix barbula Charp. On plants and cacti. Puerto Real.

Helix lactea Müll. Common at the roots of dwarf palms. Near Puerto Real.

Helix marmorata Fer. Ascends walls of houses at Port Mary, doubtless feeding on lime.

Helix nemausensis Bgt. One example.

Alexia myosotis Drap. Puerto Real, on mud flats, dead.

Alexia firmini Payr. Two Examples. Puerto Real.

Siphonaria algesirae Q. & G. Beaches. Not rare.

Bulla striata Brug. From the number of dead shells this must live in the bay.

Haminea elegans Leach. Several.

Conus mediterranea Hw. Not plentiful.

Mangilia vauquelini Payr. Brown-banded form.

Surcula undatirugata Biv. Mrs. Whishaw.

Clathurella linearis Mtg. A distinct little species.

Marginella miliaria L. Numerous in drift.

Marginella philippii Mont. With the latter.

Cymbium olla L. Mrs. Whishaw, several.

Pisania maculosa Lk. Not common.

Pisania d'orbignyi Payr. Mrs. Whishaw. Finely colored.

Euthria cornea L. Mrs. Whishaw. Nassa corniculum Oliv. A few.

Nassa corniculum raricostata Risso. Aperture violet.

Nassa incrassata Müll. A common orange-colored shell.

Nassa mutabilis L. Minor form.

Nassa reticulata L. Plentiful in muddy stations with the following :

Cyclonassa neritea L. Alive in vast numbers.

Cyclonassa pellucida Risso. A single specimen.

Columbella rustica L. Mrs. Whishaw, several.

Murex brandaris L. Apparently rare.

Murex erinaceus L. Many worn shells, seldom fresh.

Purpura haemostoma L. In a semi-fossil condition near Puerto Real.

Lotorium cutaceus L. The three of this family from fishermen.

Lotorium corrugatum Lk. Lotorium nodiferum Lk.

(*To be continued.*)

NOTES.

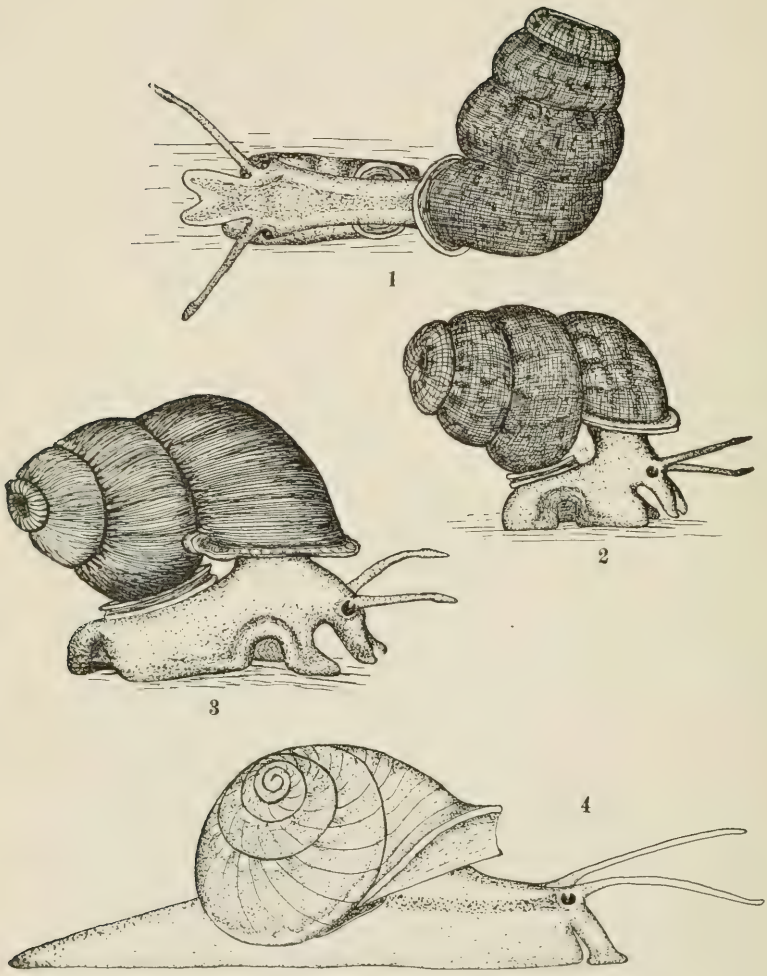
PLAGUE OF HUGE SNAILS.—A plague of snails on the coast of Ceylon is assuming serious proportions. Millions of snails are to be found, and some of them weigh as much as one pound. The snails have begun feeding on the young cocoanut trees, and it is feared that they may attack the young rubber trees. The government is taking measures to check the devastation.—*London Daily Chronicle.*

THE VIRGINIA COLONY OF HELIX NEMORALIS.—In a recent letter from Mrs. John M. Brooke she says: "Of *Helix nemoralis* I have seen very little of late, my home having been in Washington, D. C., for about three years. On my return to Lexington, Va., in August of this year there seems to be no diminution, however, in numbers that came out after a rain, the prevailing colors being the plain lemon-yellow and the regular five-banded form, but I have made no careful selection. We have had a terrible drouth, and they keep under shelter in dry weather, so I am unable to give you any connected observations. Only after a rain do they come out upon the rocks and fences in numbers."—C. W. J.

SIR CHARLES ELIOT is the author of a supplement to Alder and Hancock's well-known work, "The British Nudibranchiate Mollusca," published by the Ray Society. Important chapters on bionomics, classification, anatomy, etc., precede the descriptions of genera and species. Eight colored plates, partly from drawings left by Hancock, illustrate the work.

WE learn with deep regret of the death on September 25th of Dr. Oskar Boettger, of Frankfort a. M., equally known for his work in malacology, palæontology, and herpetology.

MESSRS. FERRISS, PILSBRY and DANIELS have returned from their camps in Arizona, where about ten weeks were spent in the Santa Rita, Baboquivari, Santa Catalina and Dragoon mountains, and in the Hachita Mts., N. M. About twenty-five new species of land shells are among the spoils of the expedition.



1, 2, ADAMSIELLA IRRORATA. 3, COLOBOSTYLUS BRONNII.
4, HELICINA NERITELLA ANGULATA.

The Nautilus.

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THE METHOD OF PROGRESSION OF SOME LAND OPERCULATES FROM JAMAICA.

BY AMOS P. BROWN, PH. D.

Certain operculate land snails from Jamaica, especially members of the genera *Annularia*, *Colobostylus*, *Tudora*, *Adamsiella* and their allies in the *Ericiidæ*, move very rapidly as compared to other land snails of similar size. They are not only rapid in their movements, but erratic; they change the direction of movement abruptly. All are very timid, and quick to contract the body within the shell when disturbed; a shadow thrown on one crawling in the sun is sufficient to cause contraction, and the animal then releases hold of the surface on which it is crawling and drops to the ground. In collecting, it is necessary to avoid startling them by a jar of the surface on which they are progressing, otherwise they instantly fall and are lost in the leaf-covered surface of the ground. This character, no doubt, is a protective one from birds and other enemies, as land crabs, mongoose, etc.

In crawling, when undisturbed, the motion is rapid; but, as noted, its direction may be changed rapidly. This rapid change of direction is possible on account of the shortness of the surface of contact of the foot and also on account of the fact that the actual surface of contact does not involve the whole foot at any time. Observations made upon *Adamsiella variabilis* (C. B. Ad.), *A. ignilabris* (C. B. Ad.), *A. irrorata* Gloyne, *Colobostylus jayanus* (C. B. Ad.), *C. jayanus rufilabris* (C. B. Ad.), *C. banksianus* (Sow.), *C. bronnii* (C. B. Ad.), *Tudora armata* (C. B. Ad.), *Annularia fimbriatula* (Sow.) and *Stoastoma pisum* (C. B. Ad.) show that all the above land operculates

possess this type of movement. The method of progression of *Adamsiella irrorata* Gloyne, *Colobostylus bronnii* (C. B. Ad.) and *Tudora armata* (C. B. Ad.) has been carefully studied from specimens obtained in Jamaica during the past summer (1910), and an account of their movements will apply in general to all of the above species.[1]

Unlike most snails, the *entire* under surface of the foot is not applied to the surface upon which they move, but *they walk on the edges of the foot only*. The foot, when retracted into the shell, folds down the median line of the under surface; and, when protruded for walking, this same form is retained, so that ordinarily only the two outer surfaces are involved. A wave of contraction, lifting a portion of this edge of the foot, proceeds from the posterior to the anterior, the wave moving forward alternately on the two margins of the foot, and with its advance, first on the right side and then on the left, producing a swaying gait that is characteristic of the movement of all the land operculates above enumerated. The wave movement is quite independent in the two sides of the foot, and this is easily seen when the animal is examined from the under side, when crawling over a surface of glass. As the wave passes off at the anterior end of the foot on one side the succeeding wave begins at the posterior end on the other side, and thus the animal acquires the waddling or swaying gait characteristic of this type of movement. As the wave passes off anteriorly a part of the foot is lifted and moved forward; as the wave appears at the posterior end a part of the foot is lifted and moved forward also, so that seen from the front or rear especially, the animal seems to be walking upon stumpy legs, and the movement recalls that of an elephant as seen from the rear. The trail made, when moving over dry surfaces (as the animals normally have to when in their native habitat), is double, only the edges of the foot being involved, and this double trail may always be seen when these snails are actively moving about. The details of the movement in the three species that were especially examined is given below.

Colobostylus bronnii (C. B. Ad.), Figure 3. This species is larger

[1] In a recent paper on the mollusca of Mandeville, Jamaica, by Pilsbry and Brown this mode of progression is briefly described as it was observed in *Colobostylus jayanus rufilabris* (C. B. Ad.) and in *Tudora armata* (C. B. Ad.). See Proc. Acad. Nat. Sci., Sept., 1910, p. 522.

than either of the other two examined, the shell measuring 16 mm. in height, with a greatest width of 12 mm. The foot is ashy-gray, the rostrum darker, the eyes black, and the tentacles a bright aurora-red. Its movements, while rapid as compared to ordinary snails, are more deliberate than those of *T. armata* or *A. irrorata*. The length of the foot when crawling is generally 9 or 10 mm.; the width varies from 5 to 4 mm., being narrower when the movement is most rapid. The waves proceed from the posterior to the anterior alternately on either side, requiring about 7 to 8 seconds for the passage of the wave the entire length of the foot, or the wave moves forward about 1.5 mm. per second. The alternate waves on the two lobes of the foot follow each other with an interval of about 5 seconds, or they are 6–7 mm. apart on the two lobes when both waves can be seen together. The rate of progression is quite rapid, varying from 2.5 to 3 mm. per wave, or 12 double waves were observed to advance the animal 70 mm., which is an average rate of progression per minute. The surface of contact of the edge of the foot involved in the movement varies from 1 mm. wide on each side with a median interspace of 2 mm., when moving on dry or dusty surfaces, to 1.5 mm. on each side with a somewhat smaller interspace, when moving on a smooth, non-absorbent surface like glass. The trail is notably double therefore, and the two parallel marks are somewhat irregular in outline.

When moving, the shell is carried balanced on the operculum, and to obtain this balance requires some care on the part of the animal, but once the shell is adjusted to the proper position the animal moves evenly, the shell swaying from side to side from the passage of the alternate waves of contraction of the foot. The balancing of the shell on the operculum was common to all of the three species examined, and undoubtedly it seems to distribute the weight more evenly on the foot, at the same time raising the shell quite clear of the surface on which the animal is moving.

As the foot of this species is large, the character of the wave movement may be readily studied. A part of the edge of the foot is raised from the surface on which the animal is moving, involving in the fold produced about 3 mm., with a clear space of 1 mm. wide, and the fold is usually 2.5 mm. high with a clear opening of more than 1 mm. This hiatus moves forward at the rate of 1.5 mm. per second, and when it reaches the anterior end of the foot this edge is thrust forward as it is raised, so that when it is applied again to the

surface it looks, as has been stated, as though the animal was progressing by steps. This appearance is very striking when the animal is viewed from in front, but when viewed from the rear the regular alternation of the apparent steps strongly recalls the movement of an elephant, as noted above. In either position, the lifting of the edge of the foot as the wave passes off, gives the animal the appearance of advancing by leisurely strides.

Tudora armata (C. B. Ad.). In this species the wave movement is similar to that in *C. bronnii*, but it is somewhat more rapid, and the waves follow each other at a shorter interval; nevertheless the forward movement of the shell is slower on account of the shorter wave, being about 50–60 mm. per minute. The foot, when the animal is moving, is about 8 mm. long by 3 to 4 mm. wide; the surface of contact is about 1 mm. on each edge of the foot, with an interspace of some 1 mm. between the two sides of the foot when actively moving. The passage of the wave the entire length of the foot requires about 5 seconds; the alternate waves follow each other every 4 seconds, so that the two waves can generally be seen simultaneously if the moving animal is examined from the under side. Seen in this way the two waves of contraction are about 5 mm. apart, and the form of the foot resembles a swelled barleycorn. In crawling, the shell is balanced on the middle of the operculum, and the swaying gait is even more noticeable than in the last, from the proportionately greater length of the shell, which in this species measures: length, 15 mm.; width, 8 mm. Of course in all cases the first half of the last whorl rests on the operculum. The foot of this species is of a slaty-gray color, the tentacles and rostrum darker, and the eyes black.

Adamsiella irrorata Gloyne, Figures 1 and 2. This species is quicker in its movements than either of the others examined, but the actual distance traversed in unit time is less than in *C. bronnii* or *T. armata*. The wave motion is rapid; the wave of contraction traverses the entire length of the foot from back to front in 2 seconds, and the waves follow each other every 3 seconds on each side, or there are 40 waves per minute, 20 on each side. The distance traversed in this time is about 50 mm. The shells vary in size, but the foot is about 7 mm. long when the animal is in motion; its width is about 3–4 mm. As is the case with the other species, the shell is normally carried balanced on the operculum, the round of the penultimate whorl resting in the hollow of the rather small, circular operculum. As this is so

small (3 mm. in diameter) it requires considerable adjustment to get the shell properly balanced upon it, and it usually requires several trials before the shell is finally placed in the proper balance. The animal moves forward until the body is on a strain, then the shell is hitched forward and over the operculum, on which it sometimes catches at the first trial; more often this maneuver has to be repeated several times before the shell is caught in the cup of the operculum. When the balance is finally effected the animal moves steadily away, but with the rocking gait characteristic of the group. This species is excessively timid, closing at the slightest jar, or when a shadow falls upon it, and it then drops from the surface on which it is crawling to the ground, and may lie still for several minutes before the animal is again extended. On the other hand, it is very active and quick in its movements, and liable to change its direction of motion at any point.

In this species the body is of a pale yellowish flesh color, with a darker brownish pigmented mass down the back and running into the rostrum and tentacles. The foot is the same color as the rest of the body that is protruded from the shell.

Comparing the three species upon which exact observations were made, the results may be tabulated as follows:

Comparison of motion of *C. bronnii*, *T. fecundum* and *A. irrorata*.

Species.	Waves per minute on a side.	Wave traverses length of foot, seconds.	Distance traversed in 1 minute.	Distance moved per wave.
Colobostylus bronnii.....	12	7–8	70 millimeters.	3 millimeters.
Tudora fecundum	15	5	50–60 "	2 "
Adamsiella irrorata.....	20	2	50 "	1.25 "

This method of progression is so different from that of most land snails that other land operculates were examined for comparison. A species of *Helicina* (*H. neritella angulata* C. B. Ad.) collected at Montego Bay, Jamaica, from which locality *C. bronnii* and *A. irrorata*

were obtained, has been examined as to its method of progression, Figure 4. It is that of the ordinary snail, the under side of the foot being in total contact with the surface over which it moves. Observed from the under side when the animal is actively crawling over a surface of glass, the foot is seen to be extended to a length of 20 mm., or, including the labial tentacles and head segment, 24 mm.; the tentacles may be protruded about 8 mm. more. The foot proper shows a central muscular portion extending its entire length, about 3 mm. wide anteriorly and tapering to less than 1 mm. wide posteriorly; it is bounded for its entire length on each side by an area that corresponds to the edge of the foot on which the above operculates move. This has apparently the structure of the upper surface of the foot and is not involved in the muscular contractions during locomotion; it does not appear to be traversed by the contractile muscles. When the under side of the foot is observed during active motion of the animal, the middle band of the foot is seen to contract in a series of waves which traverse the length of the foot in about 10 seconds, or at a rate of 2 mm. per second. These waves follow each other closely; there are about 50 to 60 waves per minute. They move from the anterior to the posterior end of the foot, in the reverse direction of the wave movement described above for the other species. The foot is not so firm as in the above species, and while the operculum is placed under the shell it does not support it, as in the case of *Colobostylus*, *Tudora* and *Adamsiella*. The motion is perfectly even, rather slow, and of course there is no swaying of the shell from side to side which is so characteristic of the other species described.

The movement of *Stoastoma pisum* (C. B. Ad.) resembles that of the above species of *Colobostylus*, *Tudora*, etc., and it has undoubtedly been observed (though not described), for Chitty gives a figure of this species crawling which shows plainly the raised margin of the foot, due to the passage of the wave. The figure is unaccompanied by any description of this character of the animal.

NOTES ON SOME LAND SNAILS FROM KENTUCKY.

BY V. STERKI.

On September 25th last I had a few hours to look for snails at Maysville, Mason Co., Ky., in the Ohio Valley. The place was the steep northeast slope of a limestone hill and on its top, for the most

part wooded and with thick underbrush and tall annuals. On the 26th Dr. Ortmann and I collected for two hours at Pleasant Valley, Nicholas Co., Ky., in the Licking Valley, on a steep, rocky southeast slope, also limestone. At both places I had no chances to look for minutiae, could do no sifting and brushing. The list of species found is naturally short, and is given below for two reasons: probably no collecting has been done there before, and there were a few interesting forms on which some notes are added. It may be noted, by the way, that all of the *Polygyræ* found were represented at Pleasant Valley—truly pleasant to the conchologist—certainly a large number found on a small spot and in a short time of hurried collecting. In the notes, M stands for Maysville and P for Pleasant Valley.

Gastrodonta ligera Say. Abundant at M, especially on a loose, old stone wall, a large form, the shells whitish in some specimens, vividly yellow towards the aperture on others. Less common at P, much smaller, the spire higher, and in most specimens dome-shaped.

Omphalina inornata Say. At P, not common.

Omphalina lævigata perlævis Pils. Shell more depressed than that of the common form and smaller; color amber, paler at the base, reddish above; with the soft parts in the shell, the latter appears somewhat olive beneath and brownish above; the radial striæ above are slighter, less sharp, subregular, and there are no revolving lines; the nucleus has the same striæ, regular, and coarser than those on the upper part of the post-embryonal shell; diam. 17, alt. (total) 11 mill.; in other exs. 15 and 9 mill.; the radula has 29 transverse rows of m + 18(19) teeth, and there are no perfect admedian, as described by W. G. B. All specimens were alike except for differences in size.

Pleasant Valley, Nicholas Co., Kentucky. The snail has not the appearance of *O. lævigata*, rather that of *inornata*, for which it was mistaken at first sight; but the umbilicus is somewhat wider, and there are other differences, as noted. It agrees in the main with *O. l. perlævis*, though the color is different.

Hyalina indentata Say. One specimen at M.

Agriolimax campestris Binney. At both places.

Circinaria concava Say. Abundant at both places, larger at M.

Patula alternata Say. Common at M, large; less common and smaller at P.

Polygyra albolabris Say. A few specimens at P.

P. zaleta Binney. Not rare at P, mostly empty shells of decidedly

different forms. One specimen, a dead shell, which may be of the same, is high, globose, diam. 25, alt. 21 mill., with the last whorl considerably descending towards the aperture, and the latter quite inferior and oblique, somewhat triangular, like that of *P. elevata*, but there are only a little over six whorls, and the spire is less conical.

P. thyroides Say. Common at both places, abundant on the hill-top at M; rather large, with strong shell and lip.

P. pennsylvanica Green. A few at P, shell rather high.

P. mitchelliana Lea. One at P, found by Dr. Ortmann.

P. palliata Say. A few at P.

P. appressa Say. Common at M, mostly young; abundant at P, mostly dead shells.

P. inflecta Say. Common at P, quite small, diam. 9.5–10.5 mill.; color from light to brownish.

P. tridentata juxtidens Pils. Common at P, small, with a narrow umbilicus, strong lip and high parietal lamina; the curve between the upper and lower " teeth " of the peristome is narrow and rather angular at the periphery, and in most specimens there is an additional thin lamella extending downward and inward from the upper tooth. From its whole configuration this form appears to represent a variety.

P. fraterna Say. At both places. In some specimens the umbilicus is covered or nearly so, in others rather open, and the base around the umbilicus is rather excavated, as in *P. monodon* (*leai*). The surface of all is finely and densely hirsute, and the color is light brown.

P. stenotrema Fér. Common at P. There are two forms, one of them with a large notch in the peristome, and also otherwise different, as also seen from other places; a few notes on them will follow.

Bifidaria contracta Say. One at M.

B. tappaniana Ad. One at M.

NOTES ON ORIENTAL UNIONIDÆ.

BY L. S. FRIERSON.

The following notes are offered as so many "addenda et corrigenda" to Mr. Chas. T. Simpson's great work, " The Synopsis of the Naiades: "

Unio vestitus Heude.

Described by R. P. Heude in 1883 in Conch. Fluv. Nanking, VIII, plate lviii, fig. 112, and plate lix, fig. 116.

Mr. Simpson very properly changed the specific name *vestitus*, it having, as he remarks, been preoccupied by Lea. Mr. Simpson erred, however, in thinking that the two figures represented different species, so diverse as to be placed in different genera, i. e., fig. 112 a *Quadrula*, and fig. 116 a *Schistodesmus*. The two figures are, as Heude says, one species. Mr. Simpson's new name for fig. 112, *Quadrula ovata*, will have precedence, and the shell being properly a *Schistodesmus* will therefore be called *Schistodesmus ovatus* Simpson, and Mr. Simpson's name for fig. 116, *Schistodesmus spinosus*, becomes a synonym.

Unio compressus Heude.

Conch. Fluv. Nank., III, 1877, plate xxiv, fig. 52.

This specific name, being preoccupied, was changed by Mr. Simpson and called by him *Ptychorynchus incertus* Simpson, and the *Unio murinus* of Heude placed as a synonym, although the *murinus* had been published some seventeen years previously. This slip, however, was corrected in the "Errata" by Mr. Simpson by placing *murinus* as the specific name, and *incertus* Simpson becomes obsolete. But Mr. Simpson evidently overlooked the fact that this name of *compressus* had been subsequently abandoned by Heude himself, and that its natural affinities had been pointed out by Heude not once but twice. So far from being so closely allied to the *Ptychorynchus murinus* Heude, it is not even entitled to being placed in the same genus at all, but is very close to the *Nodularia douglasiæ* Gray. In fact Heude in the first mention of the species (fig. 52, plate xxiv) calls attention to its kinship to the *Unio sculptus* Deshayes, which he figures on the same plate, and which figure Mr. Simpson places as a synonym of *douglasiæ*. Afterwards Heude abandoned the name *compressus* and substituted the name *subpressus* (Conch. Fluv. Nank., IX, 1883, pl. lxv—"*Remarks opposite*"), which he then places as a variety of *douglasiæ* Gray.

(This whole double plate of *douglasiæ* Gray and its varieties, as given by Heude, is omitted by Mr. Simpson in the references under *Unio douglasiæ*, page 808, of the Synopsis.)

This shell, however, is a good species, allied to *douglasiæ*, but

differs in the truncated and much split-up cardinal teeth and the broadly rounded posterior end of the shell. The *compressus* of Heude will therefore be called *Nodularia subpressa* Heude.

(*To be continued.*)

THE DISCHARGE OF THE GLOCHIDIA IN THE UNIONIDÆ.

BY DR. A. E. ORTMANN.

Only Lea has published a few facts which bear upon the question of how the glochidia of the *Unionidæ*, contained in the marsupium, are set free (Observ., II, x), but some of his observations are entirely wrong. Further, Simpson (Pr. U. S. Mus. 22, '00, p. 616) believes that the "ovisacs" (which I call now placentulæ) of the genus *Strophitus* are discharged through the walls of the gills, which again is wrong.

According to my observations the glochidia are discharged in the natural way in the following species: *Quadrula subrotunda* (Lea), *Quadrula undulata* (Barn.), *Pleurobema coccineum* (Conr.), *Pleurobema æsopus* (Green), *Strophitus edentulus* (Say), *Symphynota costata* (Raf.), *Anodontoides ferussacianus* (Lea), *Anodonta imbecillis* Say.

This natural way is: they go from the water-tubes (ovisacs), inside of which they develop, into the suprabranchial canal, from this into the cloacal chamber, and thence go out of the soft parts and the shell by way of the anal opening.

In *Quadrula subrotunda, Pleurobema coccineum* and *æsopus*, the whole placentæ are discharged. In *Strophitus edentulus* the whole placentulæ are discharged, but sometimes the glochidia become free already in the suprabranchial canal. In the other four species named the glochidia are rather loose when discharged, and are issued in the form of irregular masses, which do not stick together, so as to preserve the shape of the placentæ.

Entirely different from these shells, which belong to the two subfamilies of the *Unionidæ* and *Anodontinæ*, is the discharge in the *Lampsilinæ*. Here the glochidia do not go out by the natural channels, but break through the walls of the gills, at the edge of the marsupium, by small holes formed for this purpose, which close again after the discharge. Each ovisac (water-tube) has one hole at its distal end, and the glochidia are generally discharged in irregular masses, rather loosely connected, without preserving the shape of the

placentæ. Only in one case, *Ptychobranchus*, the placentæ are discharged whole.

Through these holes, of course, the glochidia are emptied into the branchial chamber, and from this they must go out through the branchial opening.

I have directly observed this discharge through the edge of the marsupium in the following species: *Ptychobranchus phaseolus* (Hildr.) (specimen preserved in alcohol in the act of discharging), *Lampsilis luteola* (Lam.), *Lampsilis ventricosa* (Barn.), and *Lampsilis multiradiata* (Lea) (seen in life).

I have seen evidence of this discharge, in the shape of openings at the edge of the marsupium, in alcoholic material of *Lampsilis luteola* (Lam.), *Lampsilis multiradiata* (Lea), *Lampsilis nasuta* (Say), *Proptera alata* (Say), *P. gracilis* (Barn.), and *Obovaria circulus* (Lea).

It is very likely that the peculiar morphological structure of the marsupium of the *Lampsilinæ* is directly connected with and due to this "unnatural" discharge of the glochidia, and thus we would be able to correlate the chief morphological differentiation of the *Lampsilinæ* with a physiological differentiation. In the other two subfamilies, *Unionidæ* and *Anodontinæ*, the primitive and natural way of discharge has been preserved.

But also between these latter two subfamilies we have morphological differences which are connected with physiological differentiation: the *Unionidæ* possess the more primitive structure of the marsupium, and they are all "summer breeders," or, to express the characteristic feature, are forms with a short breeding season. The glochidia are here discharged as soon as they are fully developed. In the *Anodontinæ* we observe highly complex structures of the marsupium, which apparently are correlated with the fact that they are "winter breeders," or forms with a long breeding season. Here the glochidia, after being fully developed, are not immediately discharged, but are carried through the winter, and for this purpose special structures are present which serve for the proper aeration of the marsupium during this period.

I publish these observations and conclusions chiefly with a view to induce others to test them by looking for additional cases in other species and genera.

NOTES ON CALIFORNIA SHELLS.

BY W. H. DALL.

During the past summer I visited the Pacific coast with the object of gathering data on the tertiary and recent mollusk faunas of the

Californian region, and had the good fortune to be able to inspect nearly all the collections in private or public hands, which were of importance for my studies. I propose from time to time to give the readers of the NAUTILUS the benefit of some of my notes made during the past summer.

One of the most esthetically attractive collections on the coast, containing large series of many of the rarer Californian marine shells, is that of Dr. R. H. Tremper at Ontario, Cal. These specimens are mostly from southern California, and comprise besides mollusca a fine series of the beautifully colored brachiopods of the region, *Laqueus californicus*, the attractive crimson-tinted variety (*rubescens*) of *Terebratula transversa*, the white *Terebratulina kiiensis* (also known from Japan) and the gorgeous vermilion-streaked *Terebratula obsoleta*. Attached by their peduncles to a rock brought up on a fisherman's hook from 60 fathoms off Redondo were the first and last mentioned species, with another which I did not recognize as Californian, and which proved on comparison to be the Japanese *Terebratulina crossei* Davidson, now for the first time reported from the eastern border of the north Pacific. Another shell which seemed particularly attractive, and which was new to me, was a variety of *Lottia gigantea*, which may be called *albomaculata*, offering, instead of the usual brown and grey upper surface, the feature of being spotted with rounded white maculations regularly disposed. A pretty variety (called by Mr. Hemphill var. *Tremperi*) of the fine purple-brown *Murex carpenteri* Dall is decorated with two neat white bands below the periphery. This was obtained by Dr. Tremper in 35 fathoms, off Newport, with many of the typical form.

This collection contains, among other things, a most brilliant series of the *Pecten hastatus* Sowerby in a great number of color varieties and fully the size of the northern *P. hericeus* Gould. On some of these, near the byssal notch, were seated examples of *Capulus californicus*, now for the first time reported as commensal with any species except *P. diegensis*.

I may add to this note that through the intervention of a friend I was able to purchase at Venice a specimen of *Haliotis cracherodii*, which is believed by west coast collectors to be unique. It is a perfectly normal, moderate-sized specimen, probably obtained on the coast of Los Angeles county, rather more elevated than the average, and which has not been cleaned or modified in any way. Its peculiarity consists in the fact that it has never possessed the slightest trace of a perforation, even in the youngest stages, and there is not even a suspicion of a notch at the margin. Other specimens like Hemphill's remarkable variety *holzneri* have been seen with very few perforations (Stearns records one with only two holes and a notch), but these had earlier perforations which had been closed up and were more or less abnormal in other respects. The present specimen differs from all of them in never having had any holes whatever.

The Nautilus.

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NOTES ON ORIENTAL UNIONIDÆ.

BY L. S. FRIERSON.

Pseudodon.

This genus of shell verges on one hand into *Nodularia* and on another is close to *Virgus*. A couple of specimens of *Pseudodon resuspinatus* Martens show an outline and sculpturing very much like *Virgus*, while specimens of *Nodularia* (probably) *brandtii* from Japan show a very close kinship to *Pseudodon* in its teeth and general facies. Several specimens of *Pseudodon* having beak sculpturing show that the genus has essentially concentric and *not radial* sculpture. Hence the genus must be removed from the *Hyrianæ* and placed in the *Unioninæ* (page 515). One specimen has perfect beaks, and in this species, *P. resuspinatus* Martens, the sculpture consists of a double row of V's, one with the angle pointing down the posterior umbonal slope, the other down the anterior slope, and the arms coalescing in the middle of the shell thus, W. As the shell grows the angles become greater, so that on the body of the shell a roughly concentric sculpture finally results.

Nodularia.

Considerable changes will have to be made in this genus. *Nodularia grayana* Lea, *N. japanensis* Lea, *N. involuta* Benson, *N. pazii* Lea, *N. crispata* Gould form a heterogeneous assemblage truly. The situation is but little relieved by the several sections into which the genus is cut.

Mr. Simpson himself, in letters, states that because the *N. caffer* has been found to carry eggs in the inner gill, the section "*Cafferia*"

should be removed from *Nodularia* and be placed in *Unio* next to the Unionid section *Lapidosus*. Still the situation requires heroic treatment. One or two obvious points are:

(1) *Nodularia orientalis* Lea is placed by Mr. Simpson in this genus, it is true, as he observes, with much doubt because of paucity of material. This shell, however, both by its geographical distribution as well as by its whole facies, belongs to the genus *Rectidens*.

(2) *Nodularia pazii* Lea. This shell and *ingallsiana* Lea have sandwiched between them the *Nodularia jourdyi*. Yet these species are by no means akin, the latter being a true *Nodularia*, while for the accommodation of the other two species, and probably others, a new genus should be erected.

The *Unio ingallsiana* Lea differs generically from *Nodularia* in having little or no beak sculpturing and in having a smooth shell. Its cardinal teeth are blade-like and double in the right valve and single in the left. The cardinal teeth form a part of the general inner curvature of the shell, not having a "fulcrum" (as the buttress-like thickening of the noose supporting the cardinal teeth, and extending posterior to the adductor scar, may be called), which is so generally shown in most *Unionidæ*. The "third anterior muscular scar" is separate from the anterior adductor scar, whereas in *Nodularia* they are always confluent and not easy to differentiate.

For those shells, as the *Unio pazii* Lea (and *ingallsiana* Lea), exhibiting these characters as outlined, the writer proposes the new genus ENSIDENS. Two other peculiarities of the two species named may prove to be of generic significance, but at present they may be regarded as being of specific import merely. These are the entire confluence of the anterior adductor and the "protractor pedis" muscle scar, and that the escutcheon is half way the length of the lateral teeth.

CIVILIZATION AND SNAILS.

BY V. STERKI.

It is known that in a general way land and fresh-water mollusks have been decreasing in numbers in consequence of deforestation and cultivation of the land, directly and indirectly by the atmosphere becoming more dry, the disappearance of springs, drying up of

creeks, at least during part of the year, which means the destruction of nearly their entire faunas, the drainage of swamps, ponds and lakes. Over large parts of Ohio, e. g., there are at present probably less than twenty, or ten, per cent. of the number of mollusks which populated them fifty or seventy years ago.

And yet it appears that the effect on certain species is rather to the contrary, and some have become common, or even abundant, at some places under changed conditions. The following are examples: *Vallonia* are not common in the forest, even rarely found there, but are more frequent in the open, among grass, etc. *V. pulchella*, *excentrica* and *costata* are common, e. g., under old bricks, boards, etc., in stone heaps, in towns and cities. *V. excentrica* is living in countless numbers in lawns which are regularly sprinkled, e. g., at Pittsburg, collected by Mr. Geo. H. Clapp, and at Cleveland, by Mr. J. A. Allen. A single house lawn is populated by more individuals than there were on a thousand acres of original forest. In lawns at Hudson, O., *V. pulchella* and *excentrica* are common, as found by Dr. Rush, and there associated with *Vertigo pygmæa* Drap., which is decidedly rare in Ohio. *Zonitoides minusculus* is common at many places, under bricks and stones, in company with *Vallonia*, and *Bifidaria procera* Gld. I have found common in an old brickyard at Washington, D. C., and under limestone slabs at Cincinnati.

Gastrodonta ligera, generally not frequent in the woods, at least in eastern Ohio, is common and often abundant, e. g., on railway embankments, especially among dense plant growth, like Saponaria officinalis, and, as cited elsewhere, it was found abundant along garden walls and in thickets near houses in Kentucky. *Patula striatella* (Pyramidula cronkhitei anthonyi), rare in the forest, is occasionally found in large numbers under bricks, stones, old boards and garbage material, in contrast to *P. perspectiva*, which is strictly confined to the forest, and becoming rarer. *Agriolimax campestris* is now common in yards, gardens, around buildings, etc., and wherever *A. agrestis* is introduced it is found in largest numbers at just such places, while in Europe it has long been a pest to garden and field cultures. Also in Europe the largest numbers of existing *Limax maximus* L. are in cellars of houses, in greenhouses and similar places, and so it is in this country where the slug is introduced. Immense numbers of *Pupoides marginatus*, doing considerable damage to strawberries, and *Veronicella*, destructive to tomato plantations

on the Bahamas, are illustrative examples of how certain snails are thriving under favorable conditions.

One of the most notable instances of this kind is the following: *Bithynia tentaculata*, since its introduction from Europe, has rapidly gained ground and is now widely distributed and common, e. g., in Lake Erie. At the waterworks of Erie, Pa., where the intake is four or five miles out in the lake, about one mile outside of Presque Isle, the "wells at the pumping station are periodically filled up with these snails, which have to be taken out by the wagon loads. And they are also driven through the pipes over the city, and often plug up faucets." Examination showed that almost all are dead shells of *Bithynia*, with occasionally a *Planorbis* or *Physa* mixed in. The same trouble may be experienced at other waterworks along the lake, yet the first engineer of those at Cleveland told me that they had no difficulty of this kind so far.

It is well known that canals have been excellent habitats for mollusks, and richly populated, especially with *Unionidæ* and *Sphæriidæ*, and were highways of migration from drainage to drainage for many species. The more it is deplored by the conchologist that many of them have been neglected and abandoned of late years.

To come back to land snails, it may be said that in Europe a large number of them have become regular habitants of walls, yards, gardens, vineyards, orchards and fields, much more so than in most parts of North America, and in both respects more species and more individuals. In part this is no doubt due to the fact that "over there" a large part of the land has been deforested and cultivated for centuries, and the snails had all that time to accommodate themselves to changed conditions. However, it must be taken into account that most of western and middle Europe has a more or less maritime climate, with higher humidity of the air and less severe changes of temperature, than most of North America, which is more continental. At such places of the Old World, as mentioned, there are the many species of various groups of *Helix* (s. lat.), *Torquilla* and other *Pupidæ*, *Clausilia*, etc., most of which are out in daylight, while our *Polygyrinæ* and most other land snails (few of them conspicuous) are much more retiring and not, or rarely, seen during the day.

One effect of civilization and international and intercontinental trade and travel is the introduction of mollusca from one country or

continent to another, intentionally or accidentally, with plants, seeds, ballast, etc. A rather large number of species have come over from Europe to this country, and there is no doubt that the process will go on.

SHELLS FROM THE BAY OF CADIZ REGION.

BY MAXWELL SMITH.

(*Concluded from p. 83.*)

Cassis saburon Brug. Cassis undulata Gmel.

Morio echinophora L.

Dolium sp. Said by the fisherman to live in vast numbers in the bay.

Amphiperas spelta L. Three in drift.

Cypraea achatidea Gray. One from a fisherman. Said to have been taken here. The species I have represented in my collection from Sicily and Oran on the Algerian coast.

Cypraea pyrum. Mrs. Whishaw, several.

Trivia europea Mont. A few examples.

Erato laevis Donov. A few fine and many dead in drift. Probably lives nearby in deep water.

Chenopus pespelicani L. Mrs. Whishaw. Small form.

Triforis perversus L. Mostly young shells.

Cerithium rupestris Risso.

Cerithium vulgatum Brug. Probably living.

Bittium reticulatum Costa. The most plentiful species taken.

Vermetus subcancellatus Biv. One, worn.

Turitella communis Risso. Several.

Littorina clathratus Phil. Littorina neritoides Phil.

Littorina punctata Gmel.

Rissoa cimex L. Some with deep brown bands.

Rissoa lactea Mich. Pure white, a beautiful species.

Rissoa ventricosa Desh. The most abundant Rissoa.

Truncatella truncatula Müll. In drift.

Paludestrina acuta Drap. Common in drift. Undoubtedly also lives near.

Calyptraea sinensis L. Mrs. W.

Natica glaucina L. Appears to be this.

Natica hebraea Martyn. A well-known species.

Natica intracatoides Hid. Several.

Sigaretus philippii Weinkauff. Mrs. Whishaw has found two or three in as many years.

Adeorbis subcarinata Mtg. Fine specimens in drift.

Scala commutata Mont. Scala lamellosa ? Lam. A few.

Scala pulchella Biv. One in drift.

Leiostraca sp. May prove new.

Phasianella pulex L. Seldom fresh.

Astralium rugosum L. A large heavy shell.

Trochus lineatus Da Costa. Mrs. Whishaw. Trochus obliquata Gmel.

Calliostoma zizyphinum L. Mostly worn specimens.

Haliotis tuberculata L. Mrs. Whishaw. Fissurella nubecula L. A few.

Patella aspera Lam. Mrs. Whishaw. Patella vulgata L. Plentiful.

Polyplacophora.

Chiton marginatus Pennant. Living under stones resting on mud.

Scaphopoda.

Dentalium dentalis L. Examples vary. Some smooth.

Pelecypoda.

Ostrea angulata? Lk. May be this.

Anomia ephippium L. Innumerable valves are constantly washed on the beach.

Lima squamosa Lam. Mrs. Whishaw. A large valve.

Pecten jacobaeus L. Mrs. Whishaw.

Pecten sulcatus Born. Around Port Saint Mary.

Pecten varius L. Lives in Atlantic as well as Mediterranean.

Avicula tarentina Lam. Not rare.

Mytilus edulis L. Sold in fish markets.

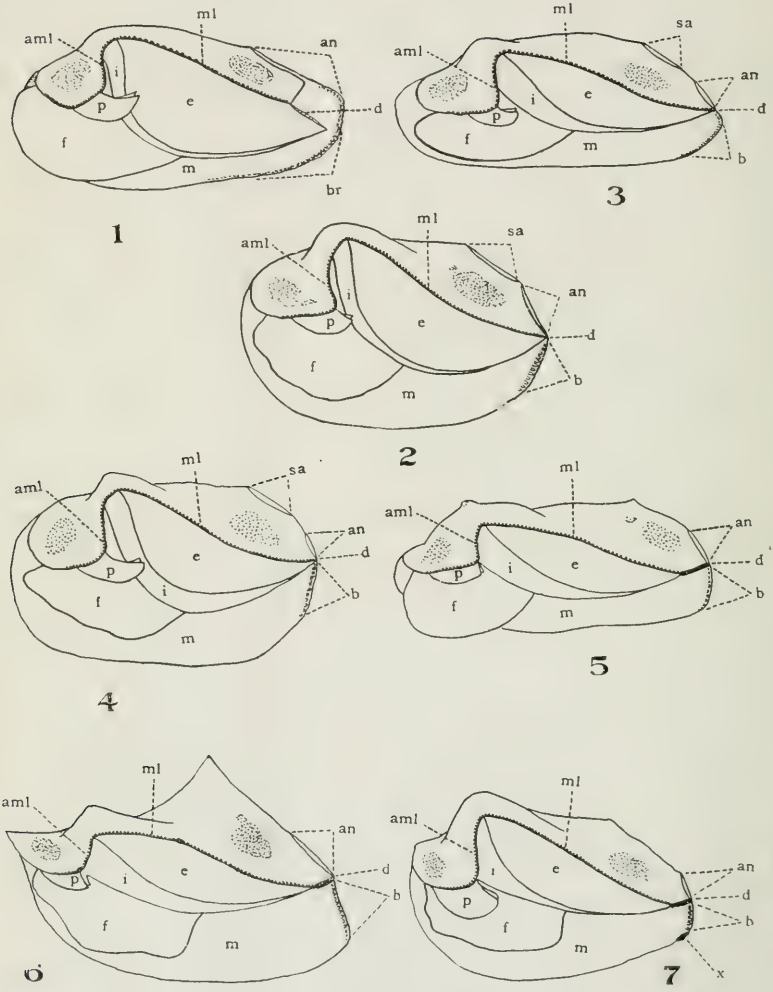
Modiola barbata Lk. Arca barbata L. Mrs. Whishaw.

Pectunculus gaditanus Gmel. Many valves.

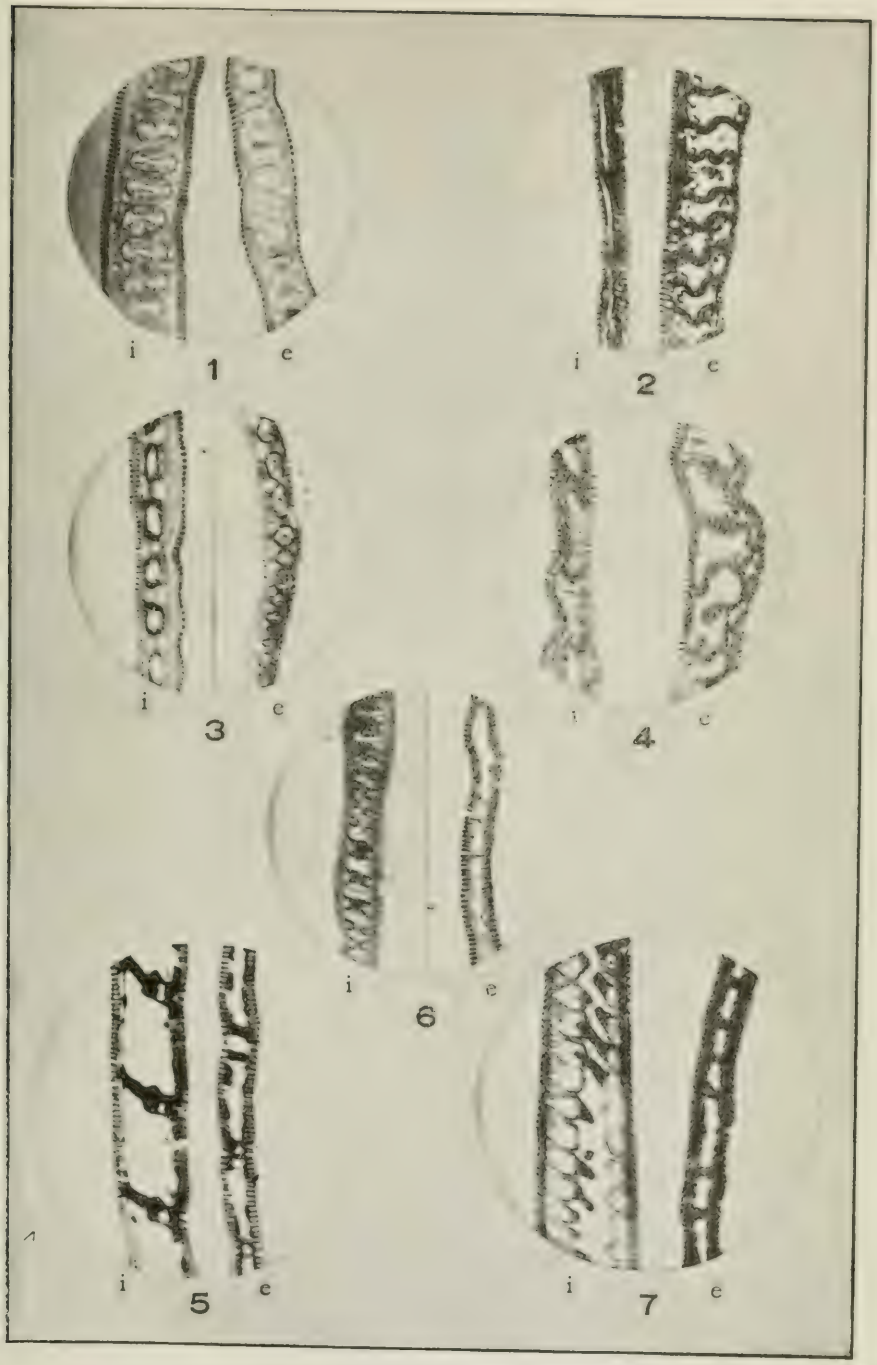
Cardita sulcata Lam. Mrs. Whishaw.

Cardium edule L. Plentiful.

Cardium edule lamarcki Reeve. Several.



ORTMANN: SOFT PARTS OF NAIADES.



OPTIMANN: SOFT PARTS OF NAIADES.

Tapes decussatus L. A distinct species.
Tapes floridus Sow. Two examples.
Venerupis iris L. A Mediterranean shell.
Donax trunculus L.
Donax vittatus Lam. Smaller than the former.
Solen vagina L. Ceratisolen legumen L.
Mactra corallina L. Common. Lutraria elliptica Lk. Mrs. Whishaw.
Pholas dactylus L. Probably will be found living.
Loripes lactea L. Single valves. Divaricella divaricata L.
Tellina cumana Costa. Not uncommon on mud flats.
Tellina distorta Poli. Rarely found.
Tellina planata L. One specimen.
Pandora inaequivalvis L. Mrs. Whishaw.

THE ANATOMICAL STRUCTURE OF CERTAIN EXOTIC NAIADES COMPARED WITH THAT OF THE NORTH AMERICAN FORMS.

BY DR. A. E. ORTMANN.

Having studied the anatomy of the soft parts of a large number of North American *Unionidæ*, I published a preliminary account of the results some time ago (NAUTILUS, Feb. 23, '10, p. 114 ff.). This had the effect that several exotic genera were submitted to me for examination, on which I have reported also (*Parreysia*, in NAUTILUS, April 23, '10, p. 139; *Spatha*, *ibid.*, August, '10, p. 39).

The peculiar facts discovered in these shells induced me to select some representative forms out of the large material of South American mussels in possession of the Carnegie Museum, and collected by Mr. J. D. Haseman, since a comparison of these with the others was much needed. A superficial examination revealed at once some very interesting features, and so I made up my mind to condense the chief results in the present paper, and to give the necessary figures to illustrate them.

Of North American types I have used for comparison the genera *Margaritana*, *Quadrula* and *Unio*. *Margaritana* stands by itself, exhibiting some quite unique features. *Quadrula* and *Unio* (together with *Rotundaria* and *Pleurobema*) are the most primitive forms among the rest of the North American *Unionidæ*, constituting my

subfamily *Unioninæ*. The other North American members of the family (*Anodontinæ* and *Lampsilinæ*) may be disregarded, since they are peculiarly developed and specialized, and have no closer relationship with the exotic forms to be discussed here. Of the latter I shall discuss the genera *Parreysia* and *Lamellidens* from Asia (India), *Spatha* from Africa, and *Hyria* and *Tetraplodon* from South America, with a few additional remarks on *Castalina*, *Diplodon*, *Glabaris*, *Fossula* and *Monocondylæa*, also from South America.

The North American Forms.

All North American *Unionidæ*, including *Margaritana*, differ from the African and South American types in two characters, not mentioned by me previously. These are the *anterior attachment of the inner gills* and the *shape of the palpi*. They agree in these with the Asiatic genera. The inner gill decreases perceptibly in width toward its anterior end; the latter is more or less in advance of the anterior end of the outer gill, and it is attached for a longer or shorter distance to the ascending part of the mantle-attachment line, but it is always distinctly separated from the posterior end of the palpi, generally by a considerable interval (see pl. v, figs. 1, 2, 3, 4). Possibly in *Unio* this interval is shortest; in all other forms (also in the *Anodontinæ* and *Lampsilinæ*) it occupies generally the larger portion of the ascending part of the mantle-attachment line. As regards the *shape of the palpi*, this character is not so sharply marked, but in the North American forms they are more or less falcate, with a posteriorly drawn out point. The hind margin of the two palpi may be more or less connected or almost free (compare the same figures on pl. VI).

As to all other characters we are to separate *Margaritana* from the rest of the North American forms, and I have created for it the subfamily *Margaritaninæ*. As I have pointed out in my first paper, the chief differences are found in the conformation of the anal and branchial openings, in that of the posterior end of the diaphragm, and in the finer structure of the gills. In *Margaritana margaritifera* (L.), branchial and anal opening form one large, uninterrupted opening, and there is on the mantle margin no distinct separation of them; the branchial is ill defined anteriorly, its papillæ passing rather far forward on the inner mantle edge and disappearing gradually, and there is no supraanal opening. In fact there is no ten-

dency whatever to unite the edges of the mantle at any point (see pl. VI, fig. 1). The diaphragm is unique in this genus: the outer lamina of the outer gills is posteriorly not connected with the mantle for a considerable distance, in consequence of which the posterior end of the gills (diaphragm) is drawn into a projecting, free point, forming a very incomplete diaphragm between the anal and branchial opening. And finally the gills possess the peculiar feature that they have no water tubes, that is to say the connection between the two laminæ is not formed by continuous septa, but by isolated and irregularly scattered subcylindrical projections of the tissue, which sometimes are arranged in indistinct and diagonal rows.

Unio and *Quadrula*, on the contrary, show a tendency to more sharply separate branchial and anal opening, and to develop a supra-anal. The diaphragm is formed by the gills, which run backward to or close to the mantle margin, the outer laminæ of the outer gills being connected with the mantle to their ends. Thus the edges of the mantle are drawn together at this point, but without growing together, which effects a sharp separation of the anal and branchial opening. Further, the anal is limited above by the coalescence of the inner mantle edges. This junction is rather short, and above it a part of the original anal is left open, the supraanal opening (the genus *Rotundaria* makes an exception, and has an anal like *Margaritana;* also in the subfamily *Lampsilinæ* we have an exception in *Lampsilis parva* (Barn.), where the anal is entirely closed above, at least sometimes). The branchial is better defined in front in these forms by the sudden disappearance of the papillæ of the inner edge.

Finally the structure of the gills is characteristic; here there are well developed water tubes, formed by septa running from base to edge of the gill, generally without any interruption.

Unio and *Quadrula* are also characterized by the marsupium (the marsupium of *Margaritana* is unknown). The water tubes (ovisacs) are narrower, and the septa are stronger and closer together than in the non-marsupial gills (see pl. VII, figs. 1 and 2). Either all four of the gills (*Quadrula*, pl. VII, fig. 1) or only the outer ones (*Unio*, pl. VII, fig. 2), in their whole length, are used as marsupium. There are no additional differentiations in the marsupial gills, the gills simply swelling during the period of gravidity, and the edges of the gills do not undergo any change (this is different in the *Anodontinæ* and *Lampsilinæ*).

The larvæ of *Unio* and *Quadrula* are glochidia of simple, semi-circular or semi-elliptical outline, with the anterior and posterior end practically undistinguishable in the shell.

Asiatic Forms.

Parreysia wynegungaensis (Lea) (see Nautilus, April, '10, pl. VI, fig. 4, and pl. VII, fig. 3) has essentially the structure of *Quadrula*. The anal and branchial openings, the diaphragm, the palpi, gills and marsupium are practically identical, as is also the general shape and insertion of the gills (the inner separated from the posterior end of the palpi). The only differences are found in the separation of the anal and supraanal, which is somewhat longer, in the attachment of the inner lamina of the inner gills to the abdominal sac, and in shell characters, chief of which is the "radial sculpture."

In addition I have investigated a species of *Lamellidens*, to which I am also indebted to the courtesy of Mr. Frierson.

Lamellidens consobrinus (Lea) from India; a sterile female is at hand. This is generally like *Parreysia* in structure, not only in those characters which agree with *Quadrula*, but also in the supra-anal, which is rather widely separated from the anal, and in the inner lamina of the inner gills, which is connected with the abdominal sac.

But there is an important exception; only the *outer gill is marsupial*, and at the posterior end of this gill *there is almost one-fourth of it of non-marsupial structure.*

The septa are of the *Quadrula* and *Unio* type, but in the marsupial part of the outer gill I observe some septa which are not complete (see pl. VII, fig. 4), i. e., they arise from either lamina without meeting in the middle of the interlaminar space; other septa are connected only by their epithelial tissue, but most of them are complete.

Possessing only a single individual, it is impossible to decide whether this is a permanent or temporary structure. It might be that the incomplete septa of the sterile female becomes complete in the gravid female.

In a general way *Lamellidens* has the same relation to *Parreysia* as *Unio* has to *Quadrula*. But it is by no means identical with *Unio*: the structure of the supraanal, the inner lamina of the inner gill and the marsupium separates it sufficiently. It remains to be seen whether the posterior part of the outer gill is always non-marsupial.

The shell of my specimen has nothing remarkable, and there is no sculpture visible near the beaks.

According to the above observations there is no question that both *Parreysia* and *Lamellidens* group with my subfamily *Unioninæ*, but that they differ generically from the North American forms. The investigation of more Asiatic types is very desirable.

African Form.

Spatha kamerunensis Walker. In Nautilus, August 24, '10, p. 39, I have given the description of the soft parts of this species. The chief differences from the North American, and also from the Asiatic, forms are the following (see pl. VI, fig. 5, and pl. VII, fig. 5):

1. The inner gill decreases very little in width in front, and is attached in its whole width to the whole length of the ascending part of the mantle-attachment line, and thus its anterior end comes in contact with the posterior end of the palpi.[1]

2. The palpi are broad and short, with a very insignificant point behind, and not at all falcate; their posterior margins are not connected.

3. The anal and branchial openings are sharply separated by a bridge, formed by the firm union of the mantle edges, which extends somewhat inward, and thus

4. The diaphragm is formed posteriorly by this bridge, and not by the gills, which do not reach the posterior mantle margin.

5. The anal opening is closed above by the union of the inner mantle edges without leaving a supraanal opening.[2]

6. The septa of the well developed water tubes are rather remote from each other and strong.

7. In the female, the inner gills alone are used as marsupium, the septa becoming wider, but not closer set (this structure practically occupies the whole gill).

Larvæ were not found in the specimens at hand.

These differences, pre-eminently 1, 3, 4, and 7, are fundamental,

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[1] The inner lamina of the inner gill is free from the abdominal sac. Accord- to von Ihering (Zool. Anz. 14, '91, p. 479, and 15, '92, p. 2) it should be connected.

[2] The anal opening is continued upward, above the rectum, as a supraanal canal, which ends blindly.

and distinguish *Spatha* at a glance from the North American shells, as well as from the Asiatic *Parreysia* and *Lamellidens*, while, as we shall see by comparison with South American shells, the shape of the palpi, and the special structure of the water tubes is not so important, and while, in the development of the anal and supra-anal opening, there are differences also in the South American shells.

South American Forms.

The following observations are new, and so it seems advisable, to give a more complete description of the structure of the soft parts of some of these forms. I select as the first, and most important, the type-genus of the *Hyriinæ*.

Hyria corrugata Lamarck. Two specimens are at hand, both females, the one sterile, the other gravid, with eggs. They have been collected by Mr. J. D. Haseman on Dec. 10, '09, on a sand bar in Rio Tapajos, at Santarem, State of Para, Brazil. (See pl. vii, fig. 6, and pl. vi, fig. 6).

Anal opening closed above by the connection of the inner mantle edges without forming a supraanal opening, closed part about twice as long as the anal opening.[1] Anal opening a little shorter than the branchial opening, separated from the latter by the solid union of the inner mantle edges. Inner edge of anal opening almost smooth, of the branchial opening with small papillæ, which stop suddenly anteriorly, thus marking the anterior boundary of the branchial opening. In front of this the inner mantle edges are smooth and perfectly unconnected. (There is nothing like "short, contractile siphons," as Simpson states on the authority of J. E. Gray, unless it should be that the inner edge of the anal is capable of expansion.)

Palpi longer than wide, not falcate, although slightly produced posteriorly, and bluntly pointed, not connected on the posterior margin.

(To be continued.)

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[1] Under the closed part extends the supraanal canal, exactly as in *Spatha*, although von Ihering asserts (Zool. Anz. 15, '92, p. 2) that in the South American *Unio* (which includes *Hyria*, etc.) there is no such canal, and that the mantle edge is affixed to the adductor muscle. The latter is impossible, since there is the rectum above the adductor.

THE NAUTILUS.

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NOTES ON CALIFORNIA SHELLS (II).

BY WILLIAM H. DALL.

Private collections at San Diego are numerous and interesting. Those of Dr. Fred Baker, Prof. Kelsey, Miss Cooke, Mr. Gripp, Mrs. Stephens and C. R. Orcutt may be especially noted.

The Biological Station formerly at La Jolla is now removed several miles northward to escape the effects of sewage, etc., from such a rapidly-growing suburb, upon the fauna. The molluscan collections are unimportant, the energies of the staff of the station, under the supervision of Dr. Ritter, being at present chiefly devoted to problems of physical hydrology. Being the nearest United States port to Lower California and the Gulf, the collectors of San Diego have unusual opportunities for obtaining specimens from these localities through small coast traders and collectors of guano and salt.

Mr. Hemphill, so long a resident of San Diego, has removed his collection to Oakland, where it is still packed up, so there was no opportunity for studying the rich collections of this veteran field naturalist. It is to be hoped they will be acquired by one of the public institutions of California, none of which at present has a truly representative series of the California shells.

BATHYTOMA TREMPERIANA, new species?

Among the various collections studied, a form of *Bathytoma* was frequently noted which is differentiated from the *B. carpenteriana* by what seem to be very constant characters. Of these Dr. Tremper has a particularly large series. It is possible that these differences

may be sexual, but, if not, it seems that it is specifically distinct. The shell is small, in the adult stage averaging about 62 mm. in length, against 90 to 110 mm. for the fully adult *carpenteriana*. It is proportionately much heavier, the anal fasciole is more strongly constricted, and the appressed margin of the whorl does not approach as closely to the periphery of the preceding whorl as in that species. The periphery is often marked by a minutely beaded or undulate thread, and is more nearly midway between the sutures on the spire than in *carpenteriana*. The aperture is shorter than the spire in nearly every case, while the reverse is true of *carpenteriana*. The average proportions of the new form, which I propose to call *B. tremperiana*, and of *B. carpenteriana*, from measurements of 8 and 25 specimens respectively, are as follows:

B. tremperiana: aperture 32.1, spire 32.2, diam. 20.7 mm.

B. carpenteriana: aperture 34.6, spire 29.4, diam. 22.6 mm.

B. stearnsiana: aperture 26.2, spire 23.2, diam. 17.8 mm.

Dr. Tremper writes me that his examination of his series of 33 specimens of *tremperiana* confirms the above distinctions.

B. tryoniana Gabb seems (after an examination of nearly all the extant specimens) to be merely a variety of *carpenteriana*, with an unusual development of tubercles or nodes on the periphery or shoulder of the whorls.

The range of *B. carpenteriana* extends from Tomales Bay, north of San Francisco, to San Diego, in 20 to 158 fathoms, and to Cerros Island. *B. tremperiana* is known from off Santa Cruz, California, south to Cerros Island, and has been dredged living in from 29 to 822 fathoms by the U. S. S. Albatross, a remarkable bathymetric range.

MODIOLUS DIEGENSIS, new species.

In Mr. Gripp's collection, which is notable for the taste and care with which the specimens are displayed, I found a small species of *Modiolus* or *Myrina* from San Diego, which seems to be undescribed.

Shell small, zoned with dark blue, the unbones usually white, covered with an olivaceous brown periostracum; anterior end very short, rounded, with two or three radial grooves externally; unbones moderately prominent; dorsal profile ascending, nearly straight, subangulate behind, the margin carried with a broad sweep to the base where it meets the posterior end of an obscure ridge radiating

from the unbones, in front of which the valves are more or less constricted, and, on the base, flattened, giving a slightly arcuate aspect to the shell; valves with a very slight rather anterior gape; interior polished, dark blue, much as in *Mytilus edulis*, the ligament long, the anterior margin with three or four crenulations corresponding to the external radial grooves. Length 19; max. height 6.5; diameter 5.5; unbones behind the anterior end of shell 1.0 mm.

This shell recalls *Adula* of Carpenter but seems not to be a borer, and is without the peculiar fine transverse sculpture of the two Californian species of *Adula*. It may possibly be referable to the genus *Myrina*.

In Miss Cooke's collection, which is notable for the Gulf of California shells collected by the late Capt. Porter, one of the things most striking to the visitor is her fine series of polished specimens of the rare red variety of *Haliotis cracherodii*. Her best specimen, of a glowing vermilion, is resplendant. Among the specimens interesting as extending the known range, in her collection, are *Mitra belcheri* Swainson, from Magdalena Bay, Lower California; *Cymatium wiegmanni*, from the same locality; *Strombus peruvianus* from the Tres Marias Islands, and *Pachypoma inæquale* without waves and with a finer type of sculpture, from San Diego. A form of *Pachypoma*, which appears to be new, is from the Gulf of California. It is somewhat smaller than the average *inæquale*, has much the same color and sculpture, but is proportionately much higher and narrower, having much the form of '*Chlorostoma*' *brunneum*. It might be called for the present *P. inæquale* var. *spiratum*.

One of the most interesting and surprising facts is conclusively proven by material in this collection. Specimens of the "*Uvanilla*" *regina*, Stearns, with the dried animal having the operculum still attached to it, show that the species is a *Tegula*,* notwithstanding the remarkable resemblance of the shell to the true *Uvanillas* of the Gulf, which possess a heavy calcareous operculum. In the *regina* the operculum is horny and moderately multispiral. This fact had indeed been previously mentioned to me, but it was not until I saw the operculum actually attached to the animal, that I was relieved of a lingering doubt as to whether some mistake had not been made.

* More commonly called by the name *Chlorostoma*.

Another interesting shell is a specimen of *Voluta deshayesii* from Clipperton Island. The vessel which brought it was a small coaster which was sent direct to the uninhabited Clipperton Island from San Diego for a load of guano, and returned to San Diego without touching at any other point. So Miss Cooke warrantably concludes that the shell could not have been obtained elsewhere; and, as it is a rather dull and battered specimen, was not likely to have been carried there, especially as there is no trade between Clipperton Island and the Australian seas.

Miss Cooke has *Fusinus luteopictus* Dall, from the Gulf of California, and *Mitra lens* from Scammon's Lagoon at the western elbow of the Lower Californian peninsula.

Several of the collectors have found *Pteria sterna* on the San Diego breakwater, and *Melina chemnitziana* at the Coronado islands, southwest of San Diego.

Mrs. Stephens has received *Rangia lecontei* Conrad from the locality known as 'Flowing Wells' in the Colorado desert.

Dr. Baker's collection contains (from 40 fathoms off San Clemente island) *Lucina edentuloides* Verrill, *Calliostoma variegatum* Carpenter, and a *Natica* not yet identified.

A NOTE ON ISAPIS OBTUSA CPR.

BY A. W. HANHAM.

Among some local species submitted to the Rev. G. W. Taylor, of the Marine Biological Station at Departure Bay, Vancouver Island, in June of 1909, was an *Isapis* which he did not recognize at the time, but all the shells were dead specimens, having been taken under stones, at low tides, inhabited by hermit crabs. Even these had not been abundant, and the small "lot" was the catch of several seasons. The species proves to be *Isapis obtusa* Cpr., and it was kindly named for me this fall by Dr. Paul Bartsch, of the United States National Museum.

It is mentioned in Keep's "West American Shells," as is also *Isapis fenestratus* Cpr., but no particular locality is given for either. The latter species is included in the Rev. G. W. Taylor's "Preliminary Catalogue of the Marine Mollusca of the Pacific Coast of Canada," but only as a great rarity. *Isapis obtusa* Cpr. is not mentioned.

There is little about *I. obtusa* to recommend it, certainly nothing graceful or beautiful, though full-grown specimens are a fair size.

The object of this note is to record the capture this summer, by accident or by luck, of living shells. As Mr. Taylor did not know it, I judged it might be a good species, and so decided that it was worth a special search this season. My earliest "hunts" in May and June, at low tides, netted me nothing except a few more dead specimens, although I carefully searched the pools at lowest tides, the exposed rocks with their covering of sea-weeds, the haunts of hermit crabs under rocks and stones, sea kelp washed up on shore, and even the inside of any large dead shell. I had about decided that nothing but dredging would bring it to light.

Towards the end of July I joined my family in camp, under canvas, at Maple Bay, for a three weeks' holiday. This Bay is 4 or 5 miles from our home on Quamichan Lake, and is situated on the east, or inside, coast of Vancouver Island. While the bay is rather shut in, it is by no means a small one, but most of the shore is rocky, with little beach. The beach proper is but little more than a quarter of a mile in length, and the greater part is a fine shale. At one end at low tide it is quite muddy, but the other has some nice patches of clean sand, with boulders liberally distributed. It was here that I had taken the dead shells, and it was here also that I went "clam digging" to replenish our larder and add some variety to camp fare. One day after turning the clams out of the pail I found quite a sediment of sand, and a rather casual examination brought to my notice several small univalves, which on closer inspection I recognized as the shell I was hunting for, and better than that, living examples, though rather immature.

The next morning I followed the tide out to the spot where I had dug the clams, but even then I failed to find any more until I started to dig more clams, and even then it was not right away that I found them. Perseverance, however, brought reward, for presently I found one on a clam, and before very long I was taking them in ones and twos, or even little groups, in this way. Perhaps not more than one clam in twenty had the *Isapis* on them, though some spots proved rich and others barren, and this I found true when digging for them on other occasions. The *Isapis* was found only on living shells, and they were liable to turn up on those dug from extreme low tide to not very far below high-water mark, and on shells that were buried from two to six inches or more.

The clam is *Tapes staminea* Conrad, and while this was the most abundant species, other bivalves, as *Cardium nuttalli*, Conrad, and some species of *Macoma* were present in fair numbers. It was however only on the *Tapes* that any *Isapis* were found. On these they adhered quite closely, so that the digging, and even a rinse did not appear to dislodge them.

While it was seldom that I found more than two or three *Isapis* on one shell, and usually only one, in several cases, I took a *Tapes* with a whole lot of small fry massed together, perhaps as many as 20 fine shells, and others had what looked like the spawn. Their position on the *Tapes* was always close to the lips, and I think nearly always in the depression close to the beaks. Besides this species I took more rarely on the *Tapes*, a species of *Odostomia* (*Ivalea*); it also occurred on the *Cardium*. Dr. Bartsch says of it, "too young to permit of positive specific identification." This *Ivalea* may have been more abundant than I found it, being of such small size, and as I discovered very easily rubbed off. It appears to me not unlikely that *Isapis fenestrata*, may have similar habits, and that therefore, where it has been taken dead and rarely, it may prove quite as plentiful as *I. obtusa* has in this case. I should say that in our Northern waters, *obtusa* must be very local, or it would surely have been turned up "dead" long before this, by the collectors, who have done considerable collecting and dredging on our British Columbia coasts.

Included in this sending to Dr. Bartsch was *Odostomia* (*Amaura*) *talpa* Dall & Bartsch, which appears to be new to our B. C. Lists, and which species I gathered in fair numbers in this same spot, at extreme low tide, all dead and containing hermit crabs.

THE ANATOMICAL STRUCTURE OF CERTAIN EXOTIC NAIADES COMPARED WITH THAT OF THE NORTH AMERICAN FORMS.

BY DR. A. E. ORTMANN.

(*Continued from p. 108.*)

Gills long and narrow, the inner the wider. Edge of inner gill with the usual longitudinal furrow, which is missing on the outer gill. Outer gill gradually narrowing anteriorly, its anterior end situated at the highest point of the mantle-attachment line. Inner

gill hardly narrower anteriorly, its anterior insertion broad, occupying the whole space between the anterior end of the outer gill and the posterior end of the palpi (the ascending part of the mantle-attachment line); the inner gill is in direct continuation of and in contact with the inner palpus, in fact the base of the latter is actually connected with the inner gill for a short distance.

Outer lamina of outer gill entirely connected with the mantle; inner lamina of inner gill entirely connected with abdominal sac; posteriorly to the foot the two inner laminæ are connected with each other as usual, thus forming the diaphragm, but the four gills do not extend as far back as to the posterior mantle margin, and the posterior part of the diaphragm is formed by the union of the two mantle edges, which form a solid bridge (*d* in the figure 6 on pl. ii). The latter is 4 mm. long, while the gill part of the diaphragm is 16 mm. long (in a specimen of which the total length of the soft parts is about 82 mm.

A male not being present, the structure of the gills cannot be made out, but it very likely is identical with the structure of the outer gill in the female.

In the female the inner gill serves as marsupium, but only the inner portion of it, about one-fourth of its length at the anterior end and a little less than one-fourth at the posterior end, being non-marsupial. The swelling of the marsupium during the breeding season is not very great, and its edge remains sharp.

In the non-marsupial outer gill a development of septa and water tubes is barely indicated, in fact there are none, as compared with North American forms. There are rather slight, indistinct and distant ridges running on the inner side of the laminæ from base to edge, parallel to the direction of the filaments, but these ridges are not connected with each other across the interlamellar cavity, except at certain points by more or less cylindrical connections. The latter are more distinct and frequent and stronger near the base of the gill; they are rather scarce and slight in the middle of the gill, and again better developed toward the edge, where they sometimes are slighly elongated and like septa. But there are no continuous septa whatever, and thus the interlamellar space is not divided into water tubes.

In the marsupial part of the inner gill the connections between the two laminæ are more crowded and numerous and become more

regular, but they do not form complete septa; an arrangement into septa is indicated in so far as the connections stand in rows, but the septa remain, so to speak, perforated, the holes in them being about as long or slightly longer than the connections, and in the most central part of the gill an alternating arrangement of adjacent rows is noticed. Thus there are no distinct ovisacs, the latter forming rather a network of communicating tubes. In the non-marsupial anterior and posterior end of the inner gills the structure is similar to the outer gill. The interlamellar connections of the marsupium are rather thick, with thick epithelium, and when the marsupium is charged they stretch out considerably.

In the gravid female at hand the marsupium was filled with eggs in various stages of development, which were rather free from each other, not forming placentæ. No fully developed larvæ were seen.

The following four characters of *Hyria* are of prime importance: 1. The closing of the anal opening above without forming a supra-anal. 2. The separation of the anal from the branchial opening by a solid bridge, formed by the union of the mantle edges (diaphragm). 3. The contiguity of the inner gill with the inner palpus. 4. The location of the marsupium in the inner gill alone. None of these characters is found in any North American shell, but all four are observed in *Spatha*. In addition, the palpi are more like *Spatha* in their general shape, although they differ somewhat.

The most important difference from *Spatha* consists of the structure of the gills, chiefly the marsupium. Septa and water tubes are very rudimentary in the non-marsupial gill, and the interrupted septa and communicating water tubes of the marsupium are quite unique. In this respect *Hyria* may be compared only with *Margaritana*, but in the latter genus the interlamellar connections are quite irregular, and do not show the slightest arrangement in rows parallel to the filaments. Although there is a certain analogy to *Margaritana* there is surely no homology.

Another important difference is the restriction of the marsupium to a part of the gill, while the complete connection of the inner lamina of the inner gill with the abdominal sac is apparently of minor value.

The conclusion is that *Hyria* undoubtedly stands nearer to *Spatha* than to any of the North American genera, and that it is as widely

remote from the so-called "*Hyriinæ*" of Asia, at least from the two investigated genera, *Parreysia* and *Lamellidens*.

If *Spatha* is to be placed in a family different from the *Unionidæ*, *Hyria* has to go out of the *Unionidæ* also, and has to remain with *Spatha*. Yet the differences from *Spatha* are such that possibly the separation into two subfamilies would be advisable. This suggestion will be supported by the following observations:

Tetraplodon undosus (v. Mart.).[1]

This species was collected by Mr. J. D. Haseman in the Rio Tiété, 25 miles above Itapura, State of São Paulo, Brazil, on "silty river banks," Sept. 27, '08. There are several lots at hand, and the one more closely investigated consists of four specimens with the soft parts, among them males and sterile females.

The structure of the soft parts of this species is essentially identical with that of *Hyria*, but I note the following differences (see pl. VI, fig. 7, and pl. VII, fig. 7):

Branchial opening closed in front by the firm union of the inner mantle edges (*x* in fig. 7, pl. ii). This connection is rather short, and restricted to the edge, and does not continue inward. It is easily torn by rough handling. Further in front the mantle edges are smooth and unconnected.

The palpi are rather wide and slightly produced posteriorly, with a blunt point, thus becoming almost semilunar, but not falcate; their posterior edge is connected for about one-third.

The anterior end of the inner gill is in contact with the posterior end of the inner palpus, but not connected with it.

The gill structure in the male is in both gills the same as described for the outer gill in *Hyria*. In the sterile female (pl. VII, fig. 7) it is as in the female of *Hyria*. Also here the marsupial part does not occupy the whole gill, but only a portion in the middle, leaving a larger portion free anteriorly and a smaller portion posteriorly.

Thus *Tetraplodon* is distinguished from *Hyria* not only by the shape of the shell, but also by some differences in the soft parts: the chief is the connection of the mantle edges in front of the branchial opening. Whether this is found in all species remains to be seen.

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[1] I do not understand why Simpson (Pr. U. S. Mus. 22, '00, p. 866) places this species with *Castalina* v. Ihering, since it is undoubtedly a *Castalia* (= *Tetraplodon*); von Ihering himself placed this species correctly.

However, it is present in *Tetraplodon ambiguus* (Sow.). I have examined a young specimen (male) from Santarem, collected by J. D. Haseman, together with *Hyria corrugata*. As far as could be made out it agrees also in the rest of the structure.

Possibly also the shape of the palpi are important for the distinction of these two genera.

Nevertheless, *Tetraplodon* agrees with *Hyria* in the essential characters of the soft parts, and it has the same affinity with the African *Spatha*, *Hyria* has, and it differs from *Spatha* in the same features as *Hyria*, namely, in the structure of the gills and the marsupium.

I may add, that I have also examined, superficially, a species of the genus *Castalina*, and several species of *Diplodon* from South America. In all these, the palpi, the attachment of the inner gill, the diaphragm, the anal opening and the location of the marsupium, are of the same type, as in *Hyria*, *Tetraplodon*, and *Spatha*, and the structure of the marsupium is like that of *Hyria* and *Tetraplodon*. The mantle edges are not connected in front of the branchial opening.[1]

Thus it is clear that a number of South American *Unionidæ*, subfam. *Hyriinæ*, group with the African *Spatha*, which stands, in Simpson's system, in a different family, *Mutelidæ*, distinguished, according to Simpson, by the taxodont hinge teeth, and by the embryo, which is a *lasidium* and not a *glochidium*, as in the *Unionidæ*.

So far I have seen fully developed embryos only in a species of *Diplodon*.[2] Here they are *glochidia*, of peculiar shape, not almost equilateral as in the North American forms, but distinctly inequilateral, with a low anterior and a high posterior extremity, which ends in a point at the postbasal angle.[3]

The embryo of *Spatha* is apparently unknown, in fact, the larval form, called *lasidium*, is known only in two species of the genus *Glabaris*,[4] and it is only by inference, on account of the supposed

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[1] According to v. Ihering (Zool. Anz. 14, '91, p. 477 ff.), this connection is variable in *Castalina*, present or absent.

[2] Belonging to the *delodontus* group, and allied to *æthiops* (Lea) and *wagnerianus* Simps.; it is from Rio Iguassu, Parana, Brazil.

[3] Much more oblique than the glochidium of *Diplodon peculiaris* (Lea), figured by Lea (Observ. XII, pl. 34, fig. 80).

[4] See v. Ihering, Zool. Anz. 14, '91, pp. 480–482.

similarity of the anatomy and shell, that a *lasidium* is attributed to all *Mutelidæ*. Nevertheless, it is quite probable, that *Spatha* has also a *lasidium*, for the South American genus *Glabaris* is still more like *Spatha* in its structure, than is *Hyria* and its allied forms. I have investigated a number of specimens of *Glabaris*, *Fossula*, and *Monocondylæa*, and they all had the essential structure of *Spatha*: a firm bridge separating anal and branchial opening; the same attachment of the anterior end of the inner gill; the marsupium practically occupying the whole length of the inner gill; and the gills with well-developed water-tubes and heavy, continuous septa. The differences from *Spatha* are found in the connection of the inner lamina of the inner gills with the abdominal sac, which I consider unimportant; in the shape of the palpi, which are rather variable, but always more or less rounded and broad, not falcate; and in the anal opening, which in *Glabaris*, *Fossula*, and *Monocondylæa*, is always entirely open and closed nowhere. The most interesting fact in the three latter genera is the similarity of the structure of the water-tubes and septa of the gills to that of *Spatha*. If we may say that *Hyria*, *Tetraplodon* and *Diplodon* ought to stand in the same family with *Spatha*, we must also admit *Glabaris*, *Fossula* and *Monocondylæa*, and the latter are even more closely allied to *Spatha* than the former. Thus it would be suggested that we have here one family, possibly to be called *Mutelidæ*, which is divided chiefly by the character of the gill structure and marsupium, but also by shell characters (hinge),[1] into two subfamilies, the one (*Hyriinæ*) including at least three South American genera, the other including three South American and one African genus. For the latter possibly the name *Mutelinæ* might be used, but this depends on our knowledge of the soft parts of the type-genus *Mutela*.

The conclusions to be drawn from the present investigations are:

1. Of the Asiatic so-called *Hyriinæ* at least *Parreysia* and *Lamellidens* are to be removed, and are to be associated with the North American genera *Quadrula*, *Rotundaria*, *Pleurobema* and *Unio* in the subfamily *Unioninæ* of the family *Unionidæ*.

2. The African *Mutelid* genus *Spatha* and the South American

[1] Also the larva (lasidium) might furnish a differential character. I have seen several gravid specimens of *Glabaris*, but they had only eggs, and no fully developed larvæ.

Mutelid genera *Glabaris*, *Fossula*, *Monocondylæa*, and further, the South American *Hyriinæ: Hyria*, *Tetraplodon* and *Diplodon*, group together, and their differences from the North American and Asiatic forms discussed above are such that we are fully justified in placing them in a separate family, whatever the name of the latter may be.

3. Within this Afro-American family we may distinguish two types, differing in very important characters, which might properly be subfamilies (*Hyriinæ* and *Mutelinæ*).

4. The systematic affinity of African and South American genera, already pointed out by v. Ihering, is much more striking, and much better supported, than before, and it is of the most important value for zoögeographical questions, namely, for the theory of an old connection between these continents (Archhelensis theory of v. Ihering).

5. The natural system of the *Naiades* expresses a tendency of development and specialization of three chief anatomical characters, which in turn are connected with certain functions. These are: (a) the separation of the original simple branchial chamber into two chambers, branchial and suprabranchial, by the diaphragm; (b) the restriction of the branchial and anal openings of the mantle edge to defined parts of the latter, with a tendency to form siphons; (c) the development of the gills into organs for carrying the eggs and larvæ (marsupium), and the specialization and adaptation of the gill structure for this purpose.

(a) In the development of the diaphragm three types are distinguishable. The most primitive stage is represented in *Margaritana*, where the diaphragm is formed by the growing together of the inner laminæ of the inner gills of the two sides of the body, and the fusion of the outer laminæ of the outer gills with the mantle. But here the diaphragm is yet incomplete, in so far as the outer laminæ of the outer gills remain free at the posterior end, and are not connected with the mantle to its posterior margin.

(*To be concluded.*)

NOTES.

Dr. W. H. Dall was elected president of the American Palaeontological Society at its recent Pittsburg meeting.

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SOME NOTES ON THE OLIVIDAE—III.

BY CHARLES W. JOHNSON.

The occidental species of the genus Oliva, from shell characters alone, seem to divide into two groups, the one containing the larger and beautiful *O. porphyria* Linné and the smaller *splendidula* Sowb., found only on the Pacific side from Panama to Mazatlan. The other, a group of analogous species, is represented on the Pacific side by *O. spicata* Bolten, *peruviana* Lam., *incrassata* Sol., and *julietta* Ducl., and on the Atlantic side by *O. reticularis* Lam. *circinata* Mart. and *fulgurator* Bolten. It is as difficult to clearly define the species on this coast as on the other, and specimens of *O. spicata* and *reticularis* often very closely resemble each other, thus indicating a common origin.

OLIVA SPICATA (Bolten).

Porphyria spicata Bolt., Mus. Boltenianum, p. 35, 1798.

Porphyria arachnoidea Bolt., *l. c.* p. 36, 1798.

Oliva araneosa Lam., Ann. du Mus. XVI, p. 315, 1810.

Both Bolten and Lamarck refer to the same figure by Martini (Conch. Cab., II, tab. 48, fig. 509) and Bolten refers to it a second time under *arachnoidea*. In adopting Lamarck's names, *venulata* (p. 313) should have been the species, as it appeared before *araneosa* (p. 315). The first figure referred to by Lamarck under *venulata* is in the Encycl. Meth., pl. 361, f. 5; the second reference is to Martini (II, tab. 46, f. 488) and happens to be the figure on which Bolten based his *litterata*. It includes the oblong forms scarcely separable

from the typical *spicata*, it, however, prevents the use of Lamarck's name of *litterata*. *O. graphica* and *porcea* Mart. are only shorter and more ovate forms.

Among the variations of this species is an interesting form from San Ignacio Lagoon, Lower California, collected by Mr. Henry Hemphill. It is noticeably narrower with a much higher spire and the periphery slightly angulate, the reddish reticulations are obscured by a milky-white layer. Represented in the Ford collection by six specimens bearing the manuscript name of *hemphilli*. The variety *pindarina* Ducl. (*punctata* Marr.) is the common, slightly angulate form, quite regularly marked with dark-brown or white, obsoletely marked with light-brown, frequently entirely white, fasciole reddish. Specimens in which the markings are obscured by a dark-brown layer constitute the *fuscata* Marr.; similar specimens having the form of *graphica* are *ustulata* Lam. Brown examples of the typical *spicata* might bear the name *perfecta*. Specimens abnormally angulated at the periphery constitute the *subangulata* Phil. The variety *polpasta* Ducl. is the short broad form so densely marked as to form an olive-green ground, spotted with dark-brown, and with white triangles below the suture. The variety *cumingii* Reeve is yellow, banded or streaked with brown, it often suggests *O. peruviana* Lam.

Oliva peruviana Lamarck.

This species varies greatly in color, but lacks the finely reticulated patterns of *spicata*. The typical form is spotted; those with irregular longitudinal streaks of brown are the *fulgurata* Martens (non Ads. & Rev.). The light-colored specimens might be called *livida* and the dark-chesnut-colored form *castanea* Ford, manuscript.

Oliva juliettæ Duclos.

This is apparently a good species, the thickening of the outer lip suggests a closer relationship to *O. incrassata* Sol. than to *spicata*, although the young of the three species closely resemble each other.

Oliva incrassata (Solander).

Voluta incrassata Sol., Portland Cat., p. 171, 1786.

Oliva angulata Lam., Ann. du Mus., XVI, p. 310, 1810.

Solander and Lamarck both refer to the same figures by Martini (Conch. Cab., II, tab. 47, figs. 499, 500). The *O. timorea* Ducl.

probably represents a small local variety, the locality "Timor" may well be questioned. The white form is var. *nivea* Pilsbry (NAUTILUS XXIII, 132).

OLIVA RETICULARIS Lamarck.

This is almost as variable in color as its Pacific analogue *O. spicata*, but the tendency to become more or less angulate as in that species is not apparent. The typical *reticularis* is the smaller form reticulated with pink or purplish lines, common throughout the West Indies. Large cylindrical forms from the Bahamas are figured by Marrat as *nivosa*. These resemble very closely specimens of *circinata* from the Gulf coast of Florida. The *O. pallida* Marr., probably represents an immaculate form of *nivosa*, and *quersolina* Ducl. as figured by Marrat, the albinistic form of the typical *reticularis*. Specimens of *nivosa* banded and streaked with an outer layer of brown are the *formosa* Marr., + *hepatica* Marr. (*non* Lam.) + *bifasciata* Kuster.

OLIVA CIRCINATA Marrat.

Oliva litterata Lam., Ann. du Mus., XVI, p. 315, 1810. *Non* Bolten, 1798.

Oliva circinata Marr., Sowerby's Thes. Conch. IV, Oliva, p. 21, pl. 17, fig. 277, 1880.

The study of a very large series before me shows conclusively that Marrat's *circinata* is really a form of Lamarck's *litterata* and will have to replace Lamarck's name, which is preoccupied. After describing the species Marrat says: "The Brazilian representative of the West Indian *O. litterata*. It is more rounded and symmetrical and less oblique and the lip is not so spread at the posterior end." The reference to both Brazil and West Indies is very doubtful. The locality is more likely the Gulf coast of Florida as specimens from there agree with Marrat's figure. It is readily separated from *nivosa* by its different color, darker bands and fasciculations below the suture. Specimens from the east coast of Florida are usually longer and more cylindrical. A bright yellowish form is frequently found on the Gulf coast which might bear the name of *citrina*.

OLIVA FULGURATOR (Bolten).

Porphyria fulgurator Bolt., Mus. Boltenianum, p. 36, 1798.

Oliva ispida Link, Marrat, Thes. Conch., IV, Oliva, 12, figs. 15, 16.

Oliva fusiformis Lam., Ann. du Mus., XVI, p. 318, 1810.

Oliva obesina Ducl., Monogr., in Comp. Rendus, II, tab. 16, figs. 9–11, 1835.

Both Bolten and Lamarck again refer to the same figure by Martini (Conch. Cab. II, tab. 51, f. 562) Lamarck's first reference is to a similar figure in the Encyl. Meth., plate 367, fig. 7. The markings are coarser than in *O. reticularis.* Specimens are frequently obsoletely banded or overlayed with brown. *O. bullata* Marr., seems to be a narrow form of this species.

Since my notes appeared in the October NAUTILUS my friend Mr. Charles Hedley, of Sydney, Australia, has written that *Oliva oliva* Linné should be used in place of *Oliva vidua* Bolton. In this I now agree although at first I thought it was difficult to decide just what form should bear Linné's name. Hanley says: "Still it is not unworthy of remark that the *Oliva nigrita* of Karsten (*O. maura* of Sowerby, Genera Shells) has been indicated as the principal variety or form in the 'Museum Ulricæ' and that all cited engravings (Argenville alone excepted) of the tenth edition of the 'Systema' wherein the species originally appeared, pertain to that shell."

Mr. Hedley also calls my attention to *Oliva annulata* Gmelin (Syst. Nat., p. 3441, 1792) which I have entirely overlooked. This replaces *O. amethystina* Bolten. Both references—Lister's Conch., tab. 717, f. 1, and Martini, Conch. Cab., II, tab. 51, f. 567, refer to the white form with a revolving ridge, "testa lævi alba dorsi annulo carinato." It seems unfortunate that this pale, abnormal form should become the typical, and the beautiful normal form the variety *amethystina.*

NOTES ON CALIFORNIA SHELLS. III.

BY WILLIAM H. DALL.

In a brief resumé of notable things observed in the collections on the California coast which I was privileged to visit last summer, it is impracticable to mention all the collections visited, notwithstanding nearly every one contained something of special interest, and the courtesy and hospitality of the collectors was unfailing and

limitless. I can only faintly express once for all my feeling of appreciation to each and every one of them.

In Los Angeles and its vicinity by common consent the collection of Mr, and Mrs. T. S. Oldroyd, of Signal Hill, has no equal. For years they have been gathering the shells of the coast and sparing no pains to correctly name and attractively arrange them. They have also by exchange and otherwise gathered a fine series of exotic shells. It is hoped that this entire collection will before long find a place in the fine new fireproof building Los Angeles is erecting as a public museum. It would be a calamity if the Oldroyd shells, now in a frame building far from any means of rescue, should much longer be subjected to the risk of destruction by fire. The readers of the NAUTILUS are well aware of the large number of new species, and species new to the region which have become known through the researches of Mr. and Mrs. Oldroyd, and have been described or noticed in this journal during a long series of years.

Mr. Herbert N. Lowe, of Long Beach, has gathered an interesting collection where I noted especially large and fine specimens of the *Williamia vernalis* from San Nicolas Island, and some remarkably distorted specimens of *Neverita recluziana*.

In the collection of Mrs. Zech, of Long Beach, I noticed a specimen of *Lottia gigantia* 105 x 85 millimeters in dimensions; a fine specimen from Monterey of the rare *Ovula vidleri* Sby. (1881) and a large suite of *O. barbarensis* Dall, both from Newport, Cal. In this as in most of the other local collections were remarkably large and fine *Acmæa scabra*, *persona* and *spectrum* from the new government breakwater at San Pedro, which is also the locality for remarkably clean and large *Omphalius aureotinctus* and *Calliostoma supragranosum*. A study of a very large number of the latter species indicates that *C. splendens* Cpr. may have to be reduced to varietal rank. Miss Zech has personally picked up on Vashon Island, Puget Sound, a specimen of *Chione fluctifraga*, doubtless carried there in ballast by some of the lumber vessels returning from the South.

In the collection of Mrs. Eshnaur at Terminal Island, was a specimen of the curious convex, fan-shaped variety *holzneri* Hemphill, of *Haliotis cracherodii*, from five miles south of Redondo, collected by Mr. Eshnaur. Most of the specimens so far obtained of this form are reported to have come from the Pacific coast of Lower Cali-

fornia. Also *Pinna oldroydi* from over 100 fathoms, off Newport, and *Capulus californicus* on *Pecten hastatus*, hitherto reported as commensal only with *P. diegensis*. Another ballast shell from Puget Sound was noted, in a specimen of *Oliva angulata*.

The collection of Hermann, later the Hettrick collection, formerly well-known to San Francisco collectors, and containing the largest known specimen of *Cancellaria cooperi*, is now the property of Mr. and Mrs. Golisch of Los Angeles. It offers many interesting Californian and exotic shells for study.

In Mrs. Ball's collection a fine and brightly colored series of *Angulus carpenteri* Dall (*variegatus* Cpr. not Gmelin) was especially notable, as well as many other attractive and interesting local species.

Mrs. Baldridge of Los Angeles, Mrs. Bentley and Mrs. McFarren of Venice, Dr. J. J. Rivers of Santa Monica and several other members of the flourishing Conchological Club of Los Angeles, have collections well worthy of examination. Mrs. Burton Williamson, whose contributions to the conchology of the coast are well-known, has given her collection to the new museum of Los Angeles where it will be suitably installed when the building is completed.

The San Francisco collectors were, without exception, the victims of the fire following the recent earthquake. Those of Oakland were more fortunate, and, notwithstanding the destruction caused at Stanford University by the earthquake, their collections were not seriously damaged. At Stanford is the large collection made at the Galapagos Islands by the expedition sent out by the California Academy. It was fortunate enough to arrive in San Francisco after the great disaster and when worked up by Mr. Ochsner, one of the expedition, will eventually take its place in the new Museum projected by the Academy, for which the city has offered a site in the Golden Gate Park, where the danger from fire will be almost nil.

Prof. Raymond of the University of California is working at the collection made near San Pedro, by the party directed by Prof. Ritter in 1899, which contains many interesting and novel forms. Among these was noticed a fine new species of *Calliostoma*, pure white in color. A specimen of *C. gloriosum* from Pt. San Pedro, 12 miles below the Cliff House at the entrance to San Francisco Bay, is in Prof. Raymond's collection. This, is I believe, the most northerly locality yet reported for the species.

Mr. Button's collection at Oakland is notable for its fine series of Cypræas, including some of the rarest Pacific coast forms of *Trivia*.

The collection of the University contains a number of Cooper's and Carpenter's types, but awaits a new building for its proper display.

THE ANATOMICAL STRUCTURE OF CERTAIN EXOTIC NAIDES COMPARED WITH THAT OF THE NORTH AMERICAN FORMS.

BY DR. A. E. ORTMAN.

(*Concluded from page 120*).

In all other cases the diaphragm is complete, and extends to or close to the posterior margin of the mantle, where it separates the anal from the branchial opening. Two types are recognizable, which form as many distinct and fundamentally different groups (families). In the one (*Unionidæ* of North America and Asia) the gills alone form the diaphragm. In the other (South American and African forms, possibly to be called *Mutelidæ*) the diaphragm is formed anteriorly by the gills, but posteriorly by the union of the mantle itself.

(b) The mantle edges are originally free all around. But a tendency develops soon to form two distinct openings, the siphons. In *Margaritana* the most primitive conditions are observed, and the two openings are distinguished only by the development of the papillæ. Closely allied conditions are found in a genus of typical *Unionidæ* (*Rotundaria*). But the general tendency is, among the *Unionidæ*, not only to draw the mantle edges together by the diaphragm, thus separating anal and branchial, but also to limit the anal above by the junction of the mantle edges, which, however, leaves open above the anal a supra-anal opening, which only in rare instances becomes closed (*Lampsilis parva*). The branchial opening in the *Unionidæ* is never defined anteriorly by a growing together of the mantle margins. (In the higher forms of the *Unionidæ*, subfamily *Lampsilinæ*, special structures develop in front of the branchial opening, chiefly in the female, which serve as devices for the aeration of the marsupium during the breeding season.)

In the other family (*Mutelidæ?*) the two openings are always separated from one another by a diaphragm formed by the mantle. In some cases the mantle edges are free from the rest. In other cases

the anal opening is defined above by a growing together of the mantle margins, but here a supra-anal is never formed, the fusion of the mantle edges being complete up to the upper posterior end of the two mantle halves. In addition, we find in certain forms of this group a further step in advance, which consists of the anterior demarcation of the branchial opening by a growing together of the mantle edges.

(c) The formation of the *marsupium* offers the greatest variety. It is hard to say which is to be regarded as the primitive condition, but probably originally all four gills served as receptacula for the ova, and the space between the two laminæ of each gill was not differentiated and divided.

Out of this original condition more advanced structures have developed, which generally exhibit the tendency to localize the marsupium in certain gills or parts of gills, and to divide the interlaminar space into compartments (ovi-sacs and water tubes). In the different groups these purposes have been accomplished in different ways and to different degrees. In *Margaritana* the gills do not possess partitions, and, consequently, are primitive in this respect, and apparently no water-tubes and ovisacs are found. Unfortunately, the gravid female of this form is unknown to the writer.

In the more primitive *Unionidæ* (subfamily *Unioninæ*), either all four gills still serve as marsupium, and have thus preserved the original condition, or only the outer gills serve this purpose, and further, here the interlaminar space is divided by septa into rather regular compartments, running vertically to the edge of the gills, and parallel to the gill filaments. The same fundamental characters, restriction of the marsupium to the outer gills and development of water tubes and ovisacs, are found in the more highly-developed *Unionidæ* (subfamilies *Anodontinæ* and *Lampsilinæ*), but here specializations are met with, which are to be regarded primarily as adaptations to a prolonged breeding season, and to a peculiar way of discharging the glochidia.

In the Afro-South American group of *Najades* (*Mutelidæ*?), all cases so far known show the marsupium restricted to the inner gills. Two main types may be distinguished among them, according to the inner differentiation of the marsupial gill. In one case, the marsupial part of the inner gill is rather restricted (to the middle portion), and here very incomplete and intercommunicating water tubes are formed by rows of interlamellar connections; in the other case,

complete and heavy septa separate completely isolated water tubes. In none of these cases the structure of the marsupial gill is identical with that of the *Unionidæ*, although the septa and water tubes in the latter case show certain analogies to those of the *Unionidæ*. However, the finer structure being different, I consider this a case of convergency of structure.

(7) Of these anatomical differences representing functional differentiation, we may say that the oldest must be the formation of the diaphragm, for the tendency to form siphons necessarily must start with it. Almost as old as this is the differentiation of the marsupium, and thus the location of the latter and its structure must be essential. To these characters we consequently should attribute the greatest systematic value, and thus it is evident that the genus *Margaritana*, which I have placed formerly (NAUTILUS 23, Feb., '09, p. 116) in a subfamily by itself, but within the family *Unionidæ*, should rank higher, and I do not hesitate now to call it a family. Thus we would have the following three families among the *Naiades:*

Family: MARGARITANIDÆ. Diaphragm incomplete, formed only by the gills. Anterior end of inner gills distant from the palpi. Branchial and anal siphons ill defined, and not closed above, and no supra-anal developed. Gills without water tubes and with irregularly scattered interlamellar connections. Marsupium and glochidia unknown.

Family: UNIONIDÆ. Diaphragm complete, formed only by the gills. Anterior end of inner gills distant from the palpi. Branchial and anal siphons sharply separated from one another by the diaphragm. Anal very rarely not closed above, generally closed, but with a supra-anal opening (which very rarely may be obliterated). Gills with water tubes and distinct, continuous, interlamellar septa. Marsupium in all four, or only in the outer gills. Larva a glochidium. (Contains three subfamilies: *Unioninæ*, *Anodontinæ* and *Lampsilinæ*.)

Family: MUTELIDÆ.[1] Diaphragm complete, formed anteriorly by the gills, posteriorly by the mantle. Anterior end of inner gills in contact with the palpi. Branchial and anal siphons sharply separated from one another. Anal open or closed above, but there is never a supra-anal opening. Gills with very indistinct and intercommunicating water tubes or with well-developed water tubes. Marsupium only in the inner gills.

Subfamily: *Hyriinæ*. Anal closed above. Marsupium with interrupted interlamellar connections, standing in rows, and forming incomplete, communicating water tubes. Non-marsupial gill with poorly developed, scattered interlamellar connections. Larva a glochidium. (*Hyria, Tetraplodon, Diplodon, Castalina.*)

Subfamily: *Mutelinæ*.[1] Anal open or closed above. Marsupium with well-developed, continuous septa, forming well-defined water tubes. Non-marsupial gills also with distinct water tubes. Larva a lasidium. (*Spatha, Glabaris, Fossula, Monocondylæa.*)

(8) Our chief attention should now be directed to the study of further genera from Africa and Asia, and also the European forms should be more closely investigated.

Explanation of Plates.

Plate VI.

Diagrammatic side views of the soft parts of *Naiades*, with the left half of the mantle removed along the mantle-attachment line, showing the arrangement of palpi, gills, diaphragm, anal, supraanal and branchial openings.

In all figures the letters indicate:

m. Right half of mantle.
ml. Mantle-attachment line.
aml. Ascending part of mantle-attachment line.
f. Foot.
p. Palpi.
i. Inner gill.
e. Outer gill.
sa. Supra-anal opening.
an. Anal opening.
b. Branchial opening.
d. Diaphragm.
x. Mantle connection in front of branchial opening.

Fig. 1. *Margaritana margaritifera* (L.). Specimen from Indian Run, Rene Mont, Schuylkill Co., Pa.

Fig. 2. *Quadrula subrotunda* (Lea). Specimen from Allegheny River, Kelly, Armstrong Co., Pa.

Fig. 3. *Unio gibbosus* Barn. Specimen from Little Beaver Creek, Enon Valley, Lawrence Co., Pa.

Fig. 4. *Parreysia wynegungaensis* (Lea). Specimen from Bombay, India.

Fig. 5. *Spatha kamerunensis* Walk. Specimen from Kamerun, Africa.

[1] The nomenclature depends on the knowledge of the genus *Mutela*.

Fig. 6. *Hyria corrugata* Lam. Specimen from Rio Tapajos, Santarem, Brazil.

Fig. 7. *Tetraplodon undosus* (v. Mart.). Specimen from Rio Tiété, Itapura, Brazil.

Plate VII.

Horizontal cross-sections through the gills of *Naiades*. All sections from sterile females. In all figures, i = inner gill, e = outer gill. Photographs taken with B. & L. 1-in. objective.

Fig. 1. *Quadrula pustulosa* (Lea). Specimen from Lake Erie, Cedar Point, Erie Co., O.

Fig. 2. *Unio gibbosus* Barn.

Fig. 3. *Parreysia wynegungaensis* (Lea).

Fig. 4. *Lamellidens consobrinus* (Lea).

Fig. 5. *Spatha kamerunensis* Walk.

Fig. 6. *Hyria corrugata* Lam.

Fig. 7. *Tetraplodon hasemani* nov.

(Specimens of Figs. 2, 3, 5, 6, 7 from same localities as on Plate VI: specimen of Fig. 4 from India.)

NOTES ON SOME PLIOCENE FOSSILS FROM GEORGIA WITH DESCRIPTIONS OF NEW SPECIES.

BY T. H. ALDRICH.

Some years since Prof. S. W. McCallie, State Geologist of Georgia, called my attention to a small block of soft marl in the State Museum which had a number of shells in it, and at my solicitation the same was kindly forwarded to me for examination. I found the specimens were a mixture of fresh water and marine, and that the fresh water ones seemed to be new besides being more or less distorted. The specimens were very fragile; notwithstanding the greatest care many of the most distorted were badly broken. It is hoped that a future examination will reveal more species and an assortment of forms far greater than those here described. The horizon is probably *Pliocene*, and seems to represent a southern fauna. The exact locality is four miles south of Atkinson, Wayne Co., Ga., on the Saltilla River. The list of species is as follows:

1. *Rangia cuneata* Gray. (Common, rather small.)
2. *Mulinea lateralis* Say.
3. *Mulinea congesta* Con.
4. *Dosinia* ——— sp? (Young shells.)
5. *Modiolaria* ——— sp?
6. *Gemma purpurea* H. C. Lea.
7. *Neritina* ——— sp? (Too poor for identification.)
8. *Neverita* ——— sp? (Fragments.)

New Species.

9. Potamides saltillensis n. sp. Pl. 8, figs. 1, 1a, 1b, and 1c. Shell medium, the largest specimen about an inch in length, whorls nine. Most all the specimens being decorticated; surface marked with transverse lines which vary in intensity, also becoming nodulous near the spire, generally the younger forms are cancellated (fig. 1a). In mature specimens there are three revolving lines above; the uppermost one just below the suture, being nodulous or spinose, this line continues to the base and becomes coarsely nodulous, generally making a shoulder. The other lines are less prominent and increase to 5 or 6. Suture deeply impressed, base coarsely striated. Aperture ovate and smooth, slightly channeled above and below (fig. 1 = normal form). Length of largest specimen is 24 m.m. and breadth of body whorl 9 m.m.

Remarks: Figure 1 = largest.

Figure 1*a* = young, 6 mm. in length.

Figure 1*b* and 1*c* are variations.

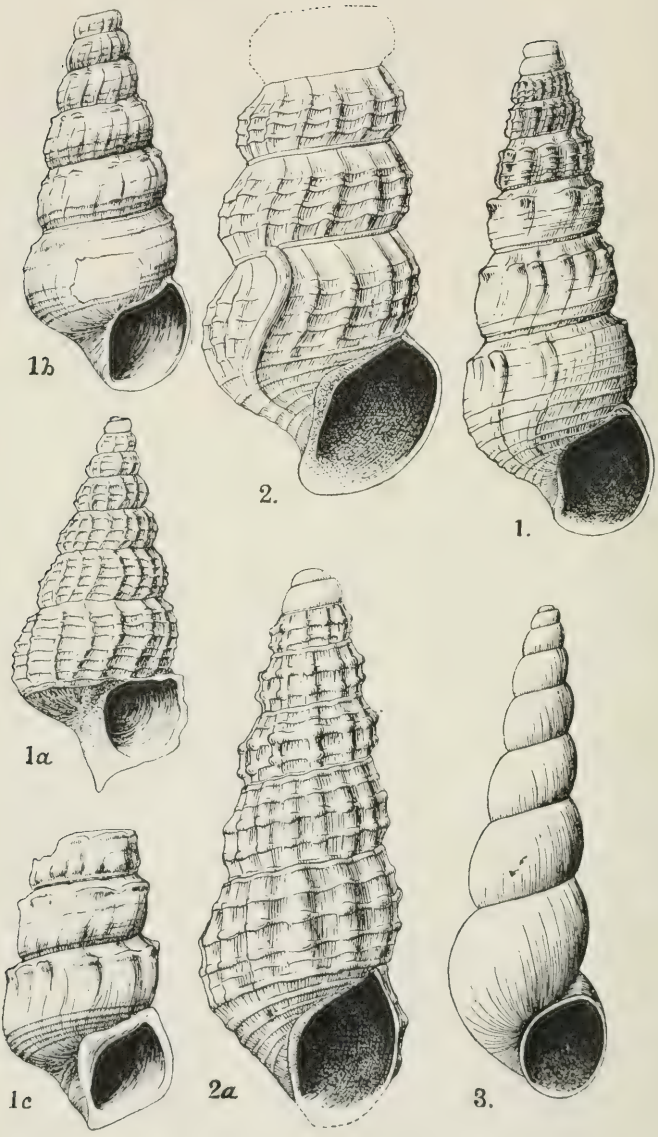
Resembles in a general way the Floridian Goniobases. Is related to lagoon forms of the Bahamas.

(*To be concluded.*)

NOTES.

Notes on Ammonitella lunata, Conrad. A paper published by Conrad in the Amer. Jour. Conch. in which he described and figured two fossil shells from the John Day region in Oregon, seems to have been overlooked by more recent writers on the same subject. The one with which this paper deals was described as Planorbis lunatus, and was collected by the Rev. Thomas Condon at Bridge Creek, Ore. It was later redescribed and figured by Stearns as *Ammonitella yatesi praecursor*, a comparison of the descriptions and figures will leave no doubt of the two being identical. The synonymy will stand as follows: *Planorbis lunatus*. Conrad, Amer. Jour. Conch., VI, p. 315, pl. 13, fig. 8, 1871; Report of Geol. Sur. P. 448, 1883; *Gonostoma yatesi*, Cooper, Bull. 18, Geol. P. 16, 1885; *Ammonitella yatesi praecursor*, Stearns, Wash. Acad. Sci., II, p. 656, pl. 35, figs. 8–12, 1900; Science n. ser. p. 153, 1902; Bull. Geol. N. C., p. 67, 1906.

Harry Edson.



ALDRICH: PLIOCENE FOSSILS FROM GEORGIA.

The Nautilus.

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COLLECTING IN MEXICO.

BY A. A. HINKLEY.

At San Dieguito, State of San Luis Potosi, February 5th, 1909, after an hour's walk to the north of town, 2 o'clock found the writer at the foot of a mountain on which a perpendicular wall of rock faces the west. It is more or less broken by openings or small ravines and shelves. Above and below the bluffs there is more or less timber, with undergrowth and creepers. From a distance it looked like a good place to find *Holospira*, *Macroceramus*, *Helicina*, *Streptostyla*, etc.

The first part of the way up the mountain was over a burned-over tract, where an occasional dead specimen of *Helicina* and *Praticolella* was to be seen, but search under loose rocks failed to disclose living specimens of either. Crossing the burned tract a heavy growth of grass was entered, through which walking was difficult. Some search was made in the grass for shells, but with no success.

When the timber was entered progress was still slower, owing to the creepers, all of which seemed to be supplied with thorns. As the bluffs were neared loose rocks became more numerous, the search here for a while producing nothing. Finally on turning a rock there lay exposed to view a single shell entirely new to me. With a thrill of delight it was picked up and examined. It was an inch and a-half long, not quite as thick as a common lead pencil, truncated at the summit, about 12 whorls remaining. Had all the whorls been present it would have exceeded two inches in length. The truncated summit, cylindric shape and color of the shell somewhat resembles *Stenogyra decollata*. Close hunting over considerable ground

resulted in finding 19 good specimens and a number of dead and broken ones, the latter looking as if some small rodent had broken them to get the animal for dinner. This shell has been named and described by Dr. Pilsbry in the NAUTILUS, Vol. 22, page 138, as *Cœlocentrum hinkleyi*. At the base of the bluffs the walking was good to what it had been below, and here are found *Macroceramus mexicanus*, *Holospira hinkleyi*, *Schasicheila hidalgoana*, *Streptostyla gracilis*, *Streptostyla supracostata*, *Helicina vanattæ* and a few dead *Euglandina corneola* and *Euglandina oblonga potosiana;* also a few specimens of a number of other species.

On the 8th of February the same bluffs were again visited. This time an early start in the morning put the writer on the ground before the sun made the climb uncomfortably warm. The entire day was put in around the bluffs and resulted in near fifty good specimens of the fine *Cœlocentrum*, but no additional species were added to the first half-day's work.

During the day a nest of small bees was encountered. This nest was made of the same material as our hornets' nests; it was trumpet-shaped, big end up, and stood at an angle from the rock to which it was attached. Being open, the bees could be seen within; they resented the presence of a stranger by buzzing about my face, but made no attempt to sting.

Standing on an elevated point of rock, which was reached after a little climb, a good view of the valley was before me. Through this valley the Mexican Central Railroad passes in nearly a straight line. The valley is cut up into small farms, occupied mostly by people from the United States who are clearing the land and planting sugar-cane, orange trees, bananas, and growing some vegetables, making homes for themselves in this mild southern country.

A COMPARISON OF THE UNIONIDÆ OF THE PEARL AND SABINE RIVERS.

BY L. S. FRIERSON.

A collection of Unios from the Pearl River, at Jackson, Miss., made by Mr. A. A. Hinkley, proves of remarkable interest, when compared with the Unios of the Sabine River, Texas; these two rivers being so far apart, and separated by the immense "bottom" of the Mississippi, which area has, in large part, a different set of inhabitants.

Pearl River.	*Sabine River.*
1. Anodontoides,	Anodontoides,
2. Gracilis,	Gracilis,
3. Cornutus,	Cornutus,
4. Aspera,	Aspera,
5. Perplicata,	Perplicata.
6. Trapezoides,	Trapezoides,
7. Heros,	Heros,
8. Purpurata,	Purpurata,
9. Confragosa,	Confragosa,
10. Donaciformis,	Donaciformus,
11. Elegans,	Elegans,
12. Tuberculata,	Tuberculata,
13. Castaneus,	Castaneus,
14. Riddelii,	Riddelii,
15. Cerinus,	Cerinus.
16. Concestator,	Nigerrimus,
17. Inflata,	Amphichæna,
18. Excavata,	Satur,
19. Claibornensis,	Hydiana,
20. Beadleana,	Askewii,
21. Refulgens, }	{ Nodifera,
22. Sphaerica, }	{ Mortonii,
23. Ebenus.	
24. Crassidens,	
25. Complanata.	

Notwithstanding the absolute identity of the first fifteen species, yet there is a well-marked *tribal* difference between the two sets, the Pearl river *U. heros* being nearly full-blooded *boykiniana*, and with a *yellow nacre.*

The *U. riddelii* of Pearl river inclines towards *rubidus*, some being of a warm, rich rose color. These Pearl river shells vary also in having the successive lines of growth so heavily impressed that the shell sometimes has *humps* as well defined as in the well-known *U. dromas* Lea.

Perhaps the most interesting feature, however, lies in the list where the species differ:

U. concestator vs. nigerrimus. Large suites of both show their identity, with only slight differences. *U. nigerrimus* is only a variety of *concestator.*

U. excavata vs. satur. These two *are the same species!*

U. satur is not, strictly speaking, a variety of *ventricosa*, but because of *priority* it is a good species, and *excavata* becomes a *synonym!*

U. claibornensis vs. hydiana. The greatest difference existing here is the lack of *rays* in *claibornensis.*

U. beadleana,
U. chickasawensis } *vs. Askewii.* These three species are *identical,* the varietal differences being no more than the different hab'tats should demand.

Proptera inflata vs. amphichæna. A suspicious piece of evidence is to be noted in the fact that where one of these species is found, there is a lack of *P. lævissima!*

However, *amphichæna* has *no wing*, even when young and perfect.

U. refulgens and *sphæricus.* These two species are identical and form a well-marked subspecies characterized by purple nacre.

U. ebenus and *crassidens* do not grow in the Sabine.

Margaritana complanata is by this find considerably extended down South. They were gravid when taken in November.

PLANORBIS BICARINATUS AND PLEURODONTE ANGULATA.

BY E. G. VANATTA.

Some recent studies have shown that the nomenclature of these species is somewhat intricate, and an examination into their history proves that the names in current use cannot be held.

The records bearing on the question follow.

PLANORBIS BICARINATUS Lamarck.

In the Ann. du Mus. Hist. Nat. Paris V, p. 36, 1804, Lamarck describes a fossil under the name *Planorbis bicarinata*, which was figured on plate 62, fig. 3 of the Annales du Muséum viii, 1806. It was also described in Animaux sans Vertèbres Supp., vii, p. 542, 1822. Deshayes in the Anim. s. Vert. Bassin, Paris, ii, p. 438, 1864, placed this species in *Adeorbis.*

PLANORBIS BICARINATUS Say (not Lam.)

In the Third American Edition of Nicholson's British Encyclopedia, Philadelphia, 1819, Conchology, pl. 1, f. 4, Say, described

Planorbis bicarinatus from the Delaware River. Sowerby, in The Genera of Shells, Planorbis f. 4, Mar. 30, 1822, named and figured this shell again as *Planorbis bicarinatus*. Amos Eaton in the Zool. Text-book, p. 194, 1826, redescribes Say's species of *Planorbis* under the generic name *Helix*, but his *Helix bicarinatus* has nothing to do with *Helix bicarinata* Sowb., Zool. Jour., 1825, p. 58, pl. 3, f. 7.

HELIX ANGULATA Rackett (not Burrow.)

Helix angulata Rack., Trans. Linn. Soc. London, xiii, p. 42, pl. 5, f. 1 (read June 1, 1819, published before 1821), was based on specimens of *Planorbis* from Lake Huron, Canada. But this name is preoccupied by *Helix angulata* Burrow, in the Elements of Conchology, by Rev. E. I. Burrow, London, 1815, pl. 26, f. 1, which is *Pleurodonte acutangula* Burr. This name was also supposed to be preoccupied, but *Planorbe anguleux* Brard, Ann. du Mus. Hist. Nat. xiv, p. 435, pl. 27, f. 23, 24, 1809, was not Latinized by him. It is merely a French name for another shell.

PLANORBIS ANTROSUS Conrad.

Described in American Journal of Science and Arts, New Haven, xxv, pt. 2, p. 343, Jan. 1, 1834, from Randon's creek near Claiborne, Alabama, is therefore the first name which can be used for the freshwater shell generally known as *Planorbis bicarinatus* Say. The next name is *Planorbis engonatus* Conrad, New Fresh Water Shells of the United States, Appendix, p. 8, pl. ix, f. 8, Oct., 1835, based upon the same species of shell from Albany, New York. *Planorbis angistoma* Hald. Monogr. Fresh Water Moll. U. S., no. 7, Planorbis, p. 7, Jan. 1, 1844, is according to Mr. Walker, Nautilus, xxiii, p. 5, probably typical *antrosus*. If this is a distinct form Conrad's name is earlier.

PLANORBIS BICARINATUS MAJOR Beck.

H. Beck in the Index Moll., p. 118, 1837, lists the name *Planorbis bicarinatus* Say, and divides it into two forms: *a. major*, from the Schuylkill River and refers to Sowb. Genera, iv, f. 4. (Mr. E. R. Sykes in the Proc. Mal. Soc. London, vii, p. 194, Sept., 1906, states that part iv, of Sowb. Genera was published on March 30, 1822), and to Wood, Index Test. Suppl. vii, 12, *Planorbis angulatus* Wood.

b. minor, New Jersey, citing with a question *Planorbis eburneus* Chemn., ix, 1123? from the West Indies, as a synonym.

As Sowerby's and Wood's names both refer to the typical form of *bicarinatus* Say, as defined in Mr. Walker's excellent paper (Nautilus, xxiii p. 1. & p. 21, 1909), the name *major* Beck becomes synonymous with that form.

The form described by Mr. Walker on p. 5, of the Nautilus xxiii 1909 should be written *corrugatus* ' Curr.' Wkr.

PLEURODONTE ACUTANGULA Burrow.

Burrow's name for the shell generally known as *Pleurodonte angulata* Fér. from Porto Rico, should be used. Part of the synonomy is given below. Pfr. (Monogr. I, p. 197, 1908) thought Burrow's shell was *Helicostyla papyracea* Brod., a mistake which was perpetuated in Manual of Conchology, ix, p. 219.

Helix acutangula Rev. E. I. Burrow, Elements of Conchology, London, 1815, pp. 183 and 248. Beck. Index Moll. 1837, p. 45, No. 6, Pilsbry, Manual Conch. ix, 1894, pp. 99 and 219.

Helix angulata Burrow, Elem. of Conch. 1815, pl. 26, f. i.; Fér., Hist. Nat. Moll. I, pl. 61, f. 2, (published after 1821 and before 1825). Gray, Ann. Philos. London, n. s. ix, p. 412, 1825. Pfr., Monogr. I, p. 297, 1848. Desh. in Fer., Hist. Nat. Moll. I, p. 343, 1850.

For the rest of the synonomy see Fér., Hist. Nat. Moll. I, p. 343 and Pilsbry, Man. Conch. ix, 1894, p. 99.

Helix angulata Fér., Tabl. Syst. Anim. Moll., Prodrome Gen., 1821, p. 36, is a nude name.

NOTES ON SOME PLIOCENE FOSSILS FROM GEORGIA WITH DESCRIPTIONS OF NEW SPECIES.

BY T. H. ALDRICH.

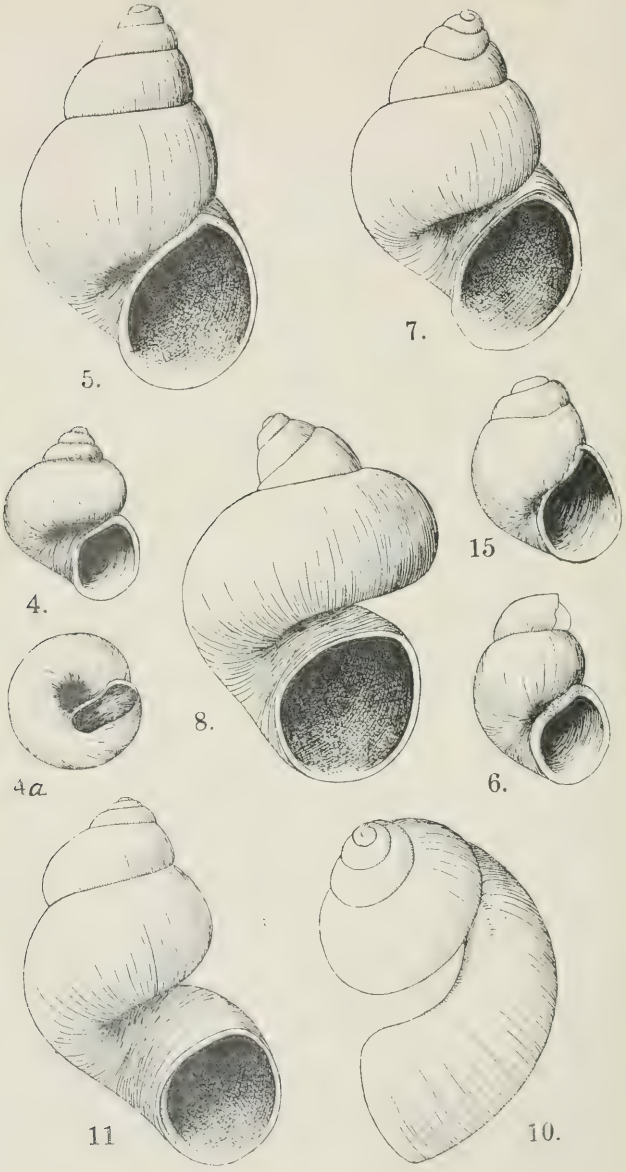
(*Concluded from page 132.*)

10. POTAMIDES CANCELLOIDES n. sp. Pl. 8, figs. 2, 2*a*.

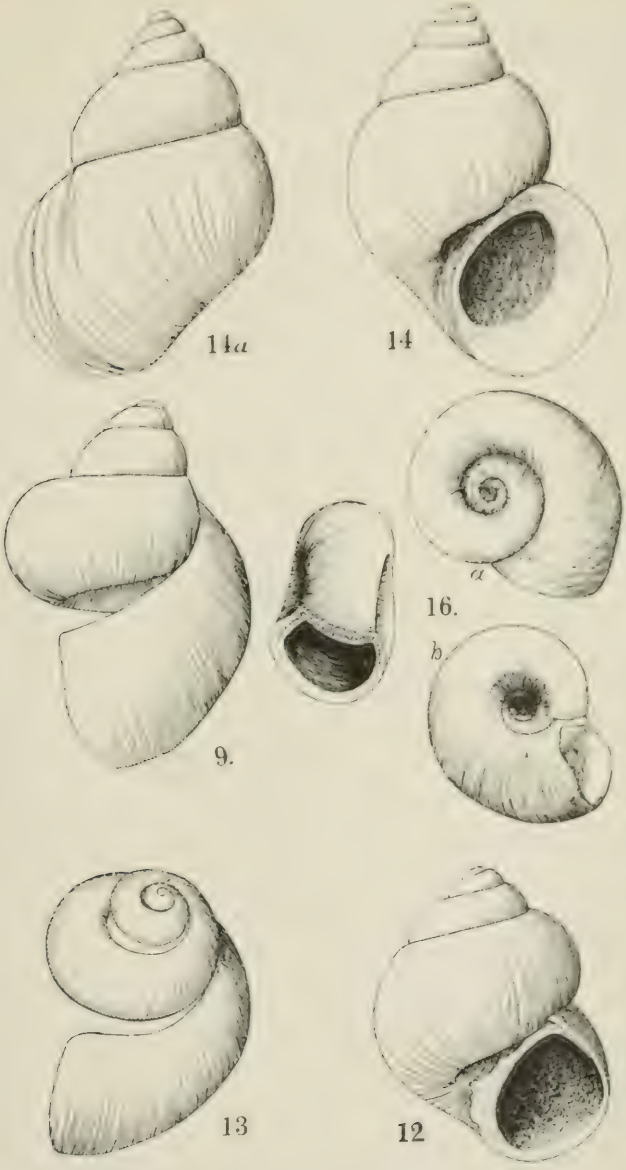
Shell small, whorls about seven or eight, first two smooth, the next three convex and cancellated, the transverse lines strongly raised, generally two in number and nodulous at the intersections.

Body whorl in both specimens carrying four or more transverse lines. Aperture ovate-elongate; canal short twisted.

Length of No. 2*a*, 3½ mm. Fully grown example is at least 15 mm.



ALDRICH: PLIOCENE FOSSILS FROM GEORGIA.



ALDRICH: PLIOCENE FOSSILS FROM GEORGIA.

Remarks: This species is smaller than the one previously described. The sides more nearly parallel, the canal more twisted, and in the young we find two strong transverse lines with a flattened space between. Sometimes they are smooth otherwise and sometimes strongly marked with raised axial lines.

11. Paludestrina plana n. sp. Pl. 8, fig. 3.

Shell small, acuminate; whorls seven, smooth and rounded, suture deep, aperture oblong-ovate, outer lip slightly expanded; peristome continuous; umbilicus open but minute.

Length 4 mm.

Remarks: In some specimens the body whorl is slightly separated from the preceding ones, probably pathologic. In others the outer lip is thickened and a slight callus shows over the inner lip. A few distorted specimens with thickened shell were obtained.

12. Amnicola saltillensis n. sp. Pl. 9, 10, figs. 5–12, 15.

The extraordinary distortions of nearly all the species of this genus makes any specific determination difficult. Three species are described; perhaps there should be four. The typical form of this species is shown in figure 5.

Shell small, surface smooth, whorls five tapering regularly, suture distinct, whorls sometimes slightly shouldered. Body whorl rotund, umbilicus small, aperture pointed slightly above, rounded at base, outer lip slightly thickened.

Height 2 mm., body whorl 1 mm. in breadth. The greater number of the distorted forms are assigned to this species.

List of illustrations is as follows:

No. 5 = normal.

No. 6 = young shell (may be distinct).

No. 7 = distorted at apex with body whorl enlarged.

No. 8 = the distortion begins with the older whorls, younger part is normal.

No. 9 = a different view of No. 8.

Nos. 10 and 11 = two views of still another form.

No. 12 = both the apical and body whorls involved.

No. 15 = young shell with the apical whorls sunken in.

13. Amnicola georgiensis n. sp. Pl. 9, 10, figs. 4, 4*a* and 13.

Similar to the preceding, not so elevated, with wider umbilicus,

whorls five, slightly shouldered, body whorl more swollen aperture pointed and slightly expanded at junction with body whorl.

Remarks: Shell as broad as it is high. Figure 4 and 4*a* is the nearest to normal obtained. In figure 13 we have all of the whorls except the apical ones entirely separated.

14. Amnicola expansilabris n. sp. Pl. 10, figs. 14, 14*a*.

Shell small, whorls five and one-half, smooth, suture deep, umbilicus small, outer lip expanded and thickened.

Height 3 mm.

Remarks: This species is the largest of all and is distinguished by its form and thickened outer lip. Strongly resembles a species of *Pachydrobia*, yet it may also be a pathologic freak. The above three species seem to be distinct, the variations and deformations may all be forms of one species. More material is necessary to decide. They certainly form an interesting study for the evolutionist.

Is it environment and food or salt and saltation?

15. Planorbis antiquitus n. sp. Pl. 10, figs. 16, 16*a* and 16*b*.

Shell small, whorls four, rather flattened above, suture moderate. Lines of growth coarser and rougher as they approach the aperture. The younger shell shows numerous very fine growth lines, umbilicus deep with straight sides, aperture flattened ovate, outer lip somewhat expanded and slightly thickened within. The peristome thin, but continuous in old specimens. The umbilicus shows more of the whorls than the upper surface.

Remarks: This form belongs to the *Planorbis bicarinatus* group and is quite distinct.

NOTES ON COLLECTING SPHAERIUM AND PISIDIUM.

BY JOHN A. ALLEN.

In collecting Sphærium and Pisidium I have obtained the shells most copiously and with the least amount of labor and eye-strain by the process described below. In Ohio the cold water and soft bottom make rubber wading-boots necessary. The collecting tool is a scoop of wire netting sold as a kitchen utensil under the name "strainer." The larger sizes, which are most efficient, usually need some improvement by cutting off projections or strengthening with solder.

The strainer is provided with a short handle. If a long handle happens to be required, the strainer can be temporarily fastened on a stick by winding around with a cord. Scrape off a slice of the bottom mud with the strainer, bring the rim above the water-surface, and swirl around. Mud and sand wash out, and a mixture of trash and shells remains. The strainer is now most easily emptied by passing it through water contained in a wash-basin. A dish-pan, if it is practicable to carry such a bulky utensil, is still better, because it will float beside the collector when working away from shore. If one is without any basin, the contents of the strainer are knocked or shaken upon a cloth.

The total product is usually carried home for treatment and put in a coarse sieve, which fits into a dish-pan or light steel kettle full of water. My sieve is made by nailing wire netting of one-fourth-inch mesh on a wooden frame. The mixture is worked with the fingers until the bivalves have passed out of the sieve into the dish. The sieve is now removed with its contents of sticks and leaves. These are looked over before being thrown away, as they often contain Physa, also may include very large *Sphæria*, such as *S. simile*, too big to pass through the sieve. Now one stirs up the water with the fingers and pours it off cautiously, puts in more water, and repeats the process as many times as required. The trash is thus washed away and a residue is obtained, consisting mainly of shells. If stones are present, a proper motion of the dish will now bring them to the opposite side from the shells, so that they can be removed. Then any conspicuous pieces of trash yet remaining are removed by hand-picking. Now, if any fine sand is present, the shells are brought into a strainer of finer mesh than the collecting strainer and washed free from it. The shells are now put in alcohol. Sometimes the use of the coarse sieve can be omitted, because little or no trash coarse enough to be retained by it is present. After one to three days the shells are taken from the alcohol and spread out to dry. If they are left too long in the alcohol there is danger of the valves opening.

The final purification can be deferred until winter, if wished. The shells are poured upon a sheet of paper in portions of about a half teaspoonful at a time, and a camel's-hair brush is used to push shells one way and dirt another. Before doing this it is often useful to remove the finest dirt, and then divide the shells into two or more sizes by a series of strainers or sieves of different mesh.

The minuter species of Amnicola may sometimes be collected by a process similar to that given above; except that for these one does not plough up the bottom, but strikes the strainer over the bottom or through the weeds. A mixture of species is usually obtained, which may be advantageously sorted with a reading glass.

NOTES ON FOSSIL CALIFORNIAN PLEUROTOMIDAE.*

BY IRA M. BUELL.

The very large collection of fossil forms of this group, made in the Pliocene of Santa Monica, California, by Dr. Rivers, formerly Curator of the Museum of the State University, has afforded the writer opportunity to institute interesting comparisons between forms previously classified under several subgenera of this group. The collection contains over one thousand specimens of these forms, hence the means to test the value of specific distinctions were far more perfect than were apparently present when the species were first described.

Subgenus Borsonia.

Distinguished by plication on columella.

1. *Borsonia hooveri* Arn. Of 27 specimens examined, 16 have faint to obsolete columellar plication. One shows three faint ridges, while the rest lack the subgeneric distinction entirely. All agree in outline and number of whorls with Arnold's type, but about half have almost obsolete nodes on apical whorl like *D. renaudi* Arn., which this approaches.

2. *Borsonia bartschi* Arn. Of 70 specimens studied, 20 show plications faint to obselete in most individuals, one has three, and one has two faint ridges on columella. About half have transverse ribs on the body whorl, and the rest are marked like *D. renaudi*,

* The Rivers Collection of above 100,000 specimens of fossil Californian Mollusca now becomes the property of Beloit College, Beloit, Wisconsin, and Pomona College, Claremont, California, half going to each of these institutions. Numerous important comparative studies have been made while the entire collection is still intact. This great collection indicates one thing with great certainty and that is that the work on the San Pedro and Santa Monica fossil Mollusca will have to be entirely recast. An examination of the material in *Fusus*, *Natica*, and other genera, indicate a condition similar to that described above for certain Pleurotomidæ.

but with fewer whorls. The specimen named by Raymond does not show plication.

3. *Borsonia dalli* Arn. Only four specimens are found under this label. Two show no plication, and the others, though plicate, have one and three more whorls than the type. In this case Arnold's figure does not agree with the description.

4. *Drillia merriami* Arn. Of ten specimens all agree with the author's figure and description in surface markings. Six have the form of *B. bartschii* but differ in the transverse ribs on the body whorl, and one has a plication on the columella. Four slender forms agree with the type, but one has nine whorls and two have plications like *Borsonia.*

5. *Drillia renaudi* Arn. Of 27 specimens examined, 10 agree in form and surface markings with *B. bartschii.* One has columellar fold almost obsolete, 20 agree with the type in the absence of ribs on the body whorl, but have from one to three fewer whorls, while 8 have faint plications on the inner lip.

6. *Drillia pedroana* Arn. Of 20 specimens examined, two broken ones agree with Arnold's figure and description, but the others have from one to three more whorls. Half of these have a distinct sutural band, while the rest approach the next.

7. *Spirotropis smithi* Arn. Of 150 specimens examined, 10 agree in form and surface markings with *D. pedroana* as above noted in the perfect forms. Several have faint spiral lines on the body whorl like the last. One half exceed the type in size, approaching 50 mm.

8. *Pleurotoma perversa* Gabb. About 600 individuals were brought together under this name in the Rivers Collection, and simply because they happened to be sinistral forms. About half are very robust, approaching 60 mm. in length, with broader, more ventricose whorls than the figure and description, but among these are a few which duplicate the dextral *S. smithi.* The smaller forms noted as "young" in the collection are more slender with flattened volutions, and absolutely duplicate, in sinistral form, the dextral types of *D. pedroana*, *B. dalli*, and *B. hooveri.*

These notes lead to rather interesting conclusions:

1. The predominating type in these beds is the sinistral. All of the smooth dextral forms, *B. dalli*, *D. pedroana*, and *S. smithi*, have exact counterparts with reversed coil.

2. This duplication of dextral and sinistral forms minimizes the value of reversal of coil as a specific distinction in this group.

3. The intergradation of supposed specific distinctions in the case of all these described species points to a most chaotic condition in the group, and suggests the need of a reclassification of the group based on broader knowledge and far more extensive material.

NOTES.

Midway-Pernambuco Fauna:—On several occasions I have called attention to the fact that Dr. White's "Cretaceous" fauna published in the Archivos do Museu Nacional do Rio de Janeiro, vol. vii, is a mixture of Midway Eocene and true Cretaceous forms (See Bull. Am. Pal. vol. i, p. 154–157.) Especially have I maintained that the Maria Farinha beds are Eocene. That in eastern Brazil there may be both Cretaceous and Eocene, alike in lithologic appearance and general attitude may well be allowed. But owing to the profound hiatus in our Southern States between the two terranes (though lithologically sometimes similar and formerly supposed to intergrade, Bull. 43, U. S. G. S.) there seemed good reason for supposing that the east Brazilian fossils represent two distinct horizons whose remains had not been carefully discriminated or labeled in the field.

In looking over a box of fossils carefully labeled as to exact horizon from eastern Venezuela a few days ago, I found the typical Midway fauna with the Maria Farinha representatives without the slightest indication of any Cretaceous forms.

The point therefore which I wish to make is this, that, if the Midway as far south as Venezuela shows no trace of Cretaceous forms, it is fair to presume that even somewhat farther south in Brazil the Midway and Cretaceous are still entirely distinct.

Again, this shows quite clearly too that, as we had often maintained, the Midwayan is a tropical, or warm-water fauna, though occurring as far north as west Tennessee. G. D. Harris.

Bermuda Shells. By E. G. Vanatta (Proc. A. N. S., Phila., 1910). Recent specimens of *Kaliella turbinata*, *Vertigo nunellata* and *marki*, and *Carychium bermudense* are recorded. These forms were described as fossils in the aeolian limestone. A fresh-water fauna was formerly supposed not to exist in Bermuda, but the following new species are now described and figured. *Physa caliban*, *Planorbis uliginosus*, *P. imus*, *Ancylus bermudensis*, *Pisidium volutabundum* and *Paludestrina bermudensis*. Mr. Vanatta also found fresh-water diatoms. Several other species new to Bermuda are recorded.

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